SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1852.—Vol. XLI. LONDON, SATURDAY, FEBRUARY 18, 1871. PRICE ..... FIVEPENCE. PER ANNUM, BY POST, £1 4s.

Original Correspondence.

BIRMINGHAM AND THE BLACK COUNTRY—No. IX.

BLAST-FURNACES.

As we have lately described one of the best blast-furnace plants in South Staffordshire, we will now proceed to notice briefly the theory of the process of extracting iron from its ores in the blast-furnace, and we shall also give particulars of the various furnaces and appliances connected therewith, having special regard to the most recent improvements. In the ore the iron exists in a state of oxide, mixed with other heterogeneous substances. The red ore, or hematite, is almost entirely pure sesquioxide of iron; the brown hematite contains a large proportion of sesquioxide of iron, mixed with earthy matter, such as lime and sand, and other substances. And the argillaceous iron ores, such as are found in the coal measures of South Staffordshire, contain protoxide of iron, mixed with the carbonates of manganese, lime, and magnesia, silicate of alumina, potash, phosphoric acid, sulphur in the state of bisulphide of iron, organic matter, and water. The latter ore—ironstone or clayband, as it is called—contains so many of these foreign substances that it is necessary it should be burnt or calcined in open heaps or in kilns before it is taken to the blast-furnace; by this means much of the volatile matter is got rid of. The action in the furnace all depends upon the ore, or mixture of ores, used—for instance, with the richer hematite it resolves itself into little more than a question of melting, as there are few impurities to be got rid of, as some of this ore yields 70 per cent. of pure iron, whilst with the argillaceous ironstone, yielding only from 30 to 40 per cent. of iron, a considerable amount of other matter has to be extricated. To rid the iron of the other matter it is necessary that a flux should be used; that most commonly employed for this purpose is limestone. In the Black Country large quantities of limestone are obtained from the Upper Silurian measures, which lie immediately under the coal measures, and are so uplifted at Dudley that they are exposed at the surface, and can easily be worked by means of caverns or shafts. The top and bottom portions of the seam worked can only be utilised, as the intermediate stratum is little more than refuse; the top is preferred for iron-smelting purposes. Now briefly to explain the chemical action in the blast-furnace. The proportion of the charges, as we have stated, all depends upon the quality of the ores used; but, to speak particularly of South Staffordshire, the furnace is charged with ore or calcined stone, coke, and limestone—that is, if what are called all mine pigs are to be made. These charges are slightly varied, according to the number of pigs required to be produced. In the furnace the ore has to be subjected to the action of carbonic oxide, so that it may be reduced and deprived of its oxygen, and then carburised, or charged with carbon, so as to become fusible. The iron ore when it is put into the furnace gradually descends, as that below it becomes purified, and is tapped off; the heat near the top deprives it of its water and carbonic acid; as it descends lower down the carbonic oxide generated in the furnace acts upon it as a reducing agent, and frees it from oxygen. It then becomes well mixed up with the flux, impregnated with carbon, and is thus rendered fusible, which it otherwise would not be; it then accumulates in the hearth, and is tapped off every 12 hours. The slag or cinder floats on the top of the molten iron, and is continually flowing out at the fall of the furnace. The proper working of the furnace can be ascertained by the colour of the cinder, which is ordinarily of a bluish-grey tint, but should the furnace go wrong this will turn to a green, and sometimes to a black. A very little matter will derange the working of a furnace; one instance came under our notice within the last few days. By mistake in the night two barrows-full of improperly calcined ironstone were introduced into the furnace, the result was that in a short time the cinder ran quite black, denoting the presence in it of sulphur and oxide of iron. This showed that the uncalcined stone had fallen to the hearth of the furnace without being properly reduced, and consequently the furnace was retarded in its work, and had to be probed and cleared, through the tuyere-houses and falls, of the cause of the interruption.

We will now speak as to the form of the blast-furnace. The old-fashioned furnaces, some of which may yet be seen at work in the Black Country, were built of a square or rectangular shape on the outside; the bottom was in some instances 40 ft. square, with arches for the tuyere-houses, and large cast-iron bearers over the falls. From the ground to a short distance above the height of the tuyere-houses there was little taper upwards of the brickwork, but from that spot to the tunnel-head the square was gradually narrowed. Bars of iron having large cast-iron washers at the ends were placed at intervals through the brickwork to prevent its cracking when subjected to expansion from the heat. The more modern furnaces are round, and yet many of these are built on large square bottoms, but those to be preferred are supported upon inclining circular brick bottoms, or upon cast-iron columns. Those built after the latter fashion are not only more proportionate, and, therefore, more pleasing to the eye, but have important advantages, as they stand on a less area, and are far more convenient, in that the men can get with greater ease and speed about them to attend to the tuyeres, and work the blast-valves. Less material is used in the improved furnaces; they are, therefore, more economical. The majority of modern furnaces are built of red brick, and lined with fire or white bricks; and to prevent the cracking from expansion, wrought-iron hoops, screwed up tight by means of nuts and bolts, are placed round the body of the furnace at intervals from top to bottom. Other furnaces are built of bricks, and covered on the outside with a cylinder of wrought-iron plates riveted together, the whole being mounted upon cast-iron columns. In these the brickwork is not near so thick as in those constructed entirely of bricks; they are light and neat in appearance. It is immaterial as to the exact form of the exterior of a blast-furnace, so that they are substantial, and yet not straggling and clumsy in appearance, but it is of the greatest importance that the interior should be of a correct shape. There has been great diversity of opinion upon this subject, but it is now pretty generally acknowledged that the inside of the furnace should be so constructed as to form no obstruction to the descent of the material, and, consequently, the form usually adopted is a uniform curve from the hearth to near the mouth. Some are almost cylindrical, tapering a little before reaching the hearth and the mouth. In the old furnaces the inclination of the boshes was far from steep, so that almost a flat surface lay above the hearth, upon which the ore, &c., was continually lodging, or scaffolding as it is termed here, and causing great inconvenience.

It is desirable that the interior of a furnace should be made with a gradual slope or curve, having the largest diameter at or near the top of the bosh, and it should be studied that this diameter be not too great, or it will be impossible to eject a sufficiency of blast for the mass of material in the centre. Although it is preferable to have but gradual slopes, yet it is necessary to take care that the slope be not too steep in the bosh just above the hearth, for it is requisite that the descent of the material should here be somewhat impeded, in order that the ore may be well saturated with carbon, and that opportunity may be given for the proper working of the flux. All sharp angles should be avoided. The dimensions of the South Staffordshire furnaces vary from about 40 to 50 ft. in height, and from 12 to 18 ft. in diameter across the widest part of the boshes. The tops of the furnaces are generally surrounded by an iron platform, up to which the raw material is raised, and then thrown into the mouths of the furnaces. The material is raised from the ground to these platforms by means of lifts or inclines. The lifts are of two sorts—pneumatic lifts, worked by the air from the blast-engine, and ordinary vertical lifts, raised by a steam-engine employed for the purpose. The inclines are most common in the Black Country; upon these are worked wagons running on rails and a toothed ratchet. The wagon is loaded with barrows at the bottom of the incline, and drawn to the furnace top by a chain, which works on small rollers on the face of the incline, passing over a pulley at the top, and returning underneath to an engine placed near the bottom or side of the incline. The blast for iron smelting furnaces is produced by steam-engines. Those generally used are condensing beam-engines, having the steam-cylinder at one end of the beam and the blowing-cylinder or tub at the other. The air follows the piston in the blowing-cylinder, having been admitted through leather flap-valves at either the top or bottom. Supposing the piston to be ascending, the air rushes through the bottom valves, filling the cylinder when the piston is at the top, preparatory to making its descent, at the commencement of which the valves at the bottom are closed, and the air is forced through a valve, working a reverse way to the others, into the main, to be conveyed either to the ovens or the furnaces. The same action takes place each side of the piston, and the valves are so constructed over the entrances to the main as to prevent the return to the blast.

A great improvement is made to the engines mentioned by allowing the beam to project at the blowing-cylinder end, and connecting it to a fly-wheel by the aid of a rod and crank. By this addition the working of the engine is made much more regular, and the stroke is dependent upon the crank instead of the valves; consequently, there is less fear of accident from the engine working over its defined stroke. Blast-engines are sometimes made horizontal, having the steam and blowing cylinders in a direct line. It is not well to adopt this plan for large engines, as the weight of the pistons is apt to wear the cylinders oval; it would, therefore, be difficult to keep them tight. Other engines have the two cylinders in a vertical line, sometimes with the blowing-cylinder at the top and sometimes at the bottom. The former plan is the best, for, although the blowing-cylinder is much the larger of the two, it does not require so firm a foundation; and when the steam-cylinder is over head the condensed steam, in the form of water, and the grease are continually running on to all beneath; but there is none of this from the blowing-cylinder. There are many blast-engines in Belgium having the blowing-cylinder over head, and these give great satisfaction. One engineering firm alone has made 50 of this class off the same patterns. The blast, in almost every instance, before going into the furnaces, is heated in ovens or stoves, as the use of hot-blast causes a great saving of fuel. Mr. Neilson, of Glasgow, invented the process of heating blast in 1828. His first apparatus consisted simply of a wrought-iron box, under which a fire was placed, and through this the blast was conveyed to the tuyere. Many improvements were made upon this plan, and at last the well-known syphon-pipe oven was arrived at. This consists of two horizontal mains placed parallel to each other, having sockets on the upper surface. Into these sockets are placed the syphon-pipes vertically, one leg of the pipe fixed in each main. These pipes gradually lessen in width towards the bend at the top, and are placed in rows of 12 and upwards to each oven. The fire-grate is between the two mains. In the centre of the influx-main there is a partition, so that the blast passes up half the number of syphon-pipes into the opposite main, and returns through the other half of the pipes into the first main, and from thence to the tuyeres. Most of the other ovens are on a similar principal to those described; the difference is in the placing of the pipes, which are sometimes fixed in a circular shape, and at other times in an oval. In these ovens the legs of the pipes are close together. We must leave our notice of the latest improvements for a future article.

THE IRONWORKS OF YORKSHIRE.

THE PARKGATE IRON COMPANY—OUR COAST DEFENCES, &c.

Of the various ironworks in South Yorkshire the largest and most important are those of the Parkgate Company, situate about two miles from Rotherham. There are, in fact, two establishments, the Parkgate and the Holmes. The last-named place has long been noted as the seat of one of the oldest ironworks in the county, and in connection with them are some interesting historical facts. So far back as 1746 Samuel Walker, who when 12 years of age was left an orphan, without property and with little education, by great diligence and perseverance managed to live by keeping a small school, a few miles from Rotherham. From setting up sun-dials, and similar odd jobs, during his spare hours, he became well known and respected by some of the leading families in the district, and with the aid of the Marquis of Rockingham and others he was enabled to commence a foundry on a small scale. Under his careful management the works rapidly extended, and became the largest and most important in the district, so that in 1793 they were valued at 134,000*l.*, and three years later (in 1796) their value had increased to 213,000*l.* The money so rapidly acquired was principally for war material, large numbers of cannon having been cast before and during the French and American war, for the English Government. At one period the works were under the management of the celebrated Thomas Paine, prior to his going to France, and the site of his residence is now pointed out. At the Holmes were produced the large iron bridges for Sunderland, Southwark, Yarm, and Staines.

At the present time the Parkgate Company give employment to about 1800 persons. They have two furnaces in blast at the Holmes, and a third in course of erection. At Parkgate there is only one furnace, but the site for two more has been marked out, so that the production of iron for the works will be very considerably more than at present. There is some very fine ore near to the works, but a good deal is being imported from Wellingborough for mixture with the local stone, from the works of Messrs. Butlin and Co., and who are now sending large quantities into both Yorkshire and Derbyshire; and as the Northamptonshire stone is found highly silicious it is well adapted for mixing with others more or less argillaceous. A large quantity of pig-iron, however, is imported from other districts, the company using many thousands of tons yearly. But it is now found advantageous to produce most of the pig at the works, seeing that there are several large collieries close at hand, including those of Earl Fitzwilliam, the Aldwarke Main, the Holmes, &c., whilst the company have a large number of coke ovens attached to the ironworks. Amongst the principal products at Parkgate are plates, rails, hoops, and merchant iron generally; but at the present time the company are extensively engaged in the manufacture of shields for the defence of our coast, and for which the Government have recently given out some very large orders. They are wrought-iron plates, of the best material, and made with great care, as nearly all of them are very minutely examined, so as to detect the slightest flaw. In one of the fitting-rooms where the shields were being prepared there was a large and varied assortment of working machinery, including six planing and three drilling machines, four lathes, four slotting machines, and a screw-making machine, amongst the makers being Thwaites and Garbut, of Bradford, and Maclea, of Manchester. The machinery was driven by a 48-horse power horizontal engine. In the second fitting-shop we found one of the shields complete, and ready for sending to its destination, which had painted on it Gravesend. It was about 18 ft. 6 in. long, and 9 ft. 4 in. high. Those shields appear to represent the framework, and to which heavy iron plates will be added. There are pillars on each side, all the iron being ¾ in. thick, whilst there is an open space in the centre, about 5 ft. in length by 3 ft. in depth, presumably the cannon port, and for certain fittings. As the plates are double all round the thickness will be 1½ in., and the shield will weigh upwards of 15 tons. When removed to the place of their destination the shields will be supplemented by the heavy armour-plates, which, we understand, are being made by the Messrs. Cammell and Co., of Sheffield. These will consist of three plates, each 5 in. in thickness, having between each a layer of some peculiar composition. Such will be the nature of the armour for the defence of our coasts, and it will be a shot or shell of no ordinary character indeed that will penetrate that vast thickness of metal, combined with other material, the iron alone being nearly a foot and a half in thickness.

Another class of shields, some of them being intended for Weymouth, were in course of being finished. One of them was 13 ft. long, 7 ft. high, and 7 ft. wide at the base, all of fine wrought-iron. It was made similar to the one previously described, but to add to its strength it was very strongly rivetted, so that in each shield there would be upwards of 6000 rivet holes, the weight being about 15 tons. In the same place were also being made on account of the Government some port or cannon frames 5 ft. 10½ in. in length by 5½ ft., and weighing about 1 ton each. There is an opening in the centre for the guns, and the frames are made of three thicknesses of iron rivetted together, each plate 1 in. thick. They are put together in sections, there being about 20 pieces in all, and with mitred joints. In connection with the shields are some rather unique machinery, including some fine multitubular drilling machines. They are driven by hydraulic power, one powerful pump being sufficient to keep three of them going. One of them, made by Ormerod and Co., of Manchester, drilled from 30 to 100 holes at a time, as required.

Great care is also taken as to the quality of the iron used for making the shields, and one or two members of the corps of Royal Engineers are constantly in the works testing the plates; whilst there we saw the tensile strength of a piece 1·33 by ·72 tested. It was the cross way of the grain, and broke after being put to a strain of fully 19 tons. The fracture was fine, and very fibrous, and the metal reduced in sectional area 1·29 by ·65.

There are several fine mills in different parts of the works, which cover a vast area of ground. In No. 1 forge there are two plate mills, 18-in. trains, with six heating furnaces. There are two engines, equal to 96-horse power, with a small one for driving the shears. There is also an excellent rail mill, a 19-in. train, with 12 heating and 2 re-heating furnaces, with straitening and punching presses. The engines are a 40-horse power and a 50-horse one. A blooming mill in the same place is driven by an engine of 18-horse power, and a rail cutter by one of 10-horse power. About 600 tons of rails are produced weekly.

The merchant mill is a 16-in. train, and connected with it are six heating furnaces. In the girder shop there is a 28-horse power engine, and in the new guide mill (there are two guide mills) there are two engines—one of 40-horse power and another for the scrap shears of 10-horse power. In the different forges there are a large number of heating furnaces, an annealing furnace, &c. The engines altogether are upwards of 520-horse power, whilst there are no less than half-a-dozen steam-hammers, varying in size from 18 to 48-horse power, together with all the usual appliances and machinery requisite for the economising of labour, and the production in the speediest manner of every description of iron. Apart from the mills and fitting departments there is a foundry where the necessary castings for the manufactured iron branches are made, together with the usual workshops for a first-class establishment. There are also gasworks for lighting the place, with a locomotive engine for conveying the material to and from the works.

Of puddling-furnaces there are at the present time no less than 84 at work, by far the largest number in the district. There are, however, some patent ones being erected. One of the latter had commenced working for the first time whilst we were being shown round, and there was quite a crowd of puddlers watching it with an all-absorbing interest, as that body, as a rule, look upon all inventions for puddling iron as innovations specially designed with a view to their injury. It was apparent, however, that no room was left for fault-finding, but plenty for disappointment at what was evidently a success. The patentee of the furnace is Mr. Caddick, of Ebbw Vale, South Wales. It is what may be termed a double furnace, being worked at the same time at the opposite sides, so that two heats are got out in about the same time as one heat by the ordinary furnace,

so that a great saving of fuel is effected. By an arrangement of columns of water in pipes at each side of the door, not only is there a saving in the fettling, but the place before the grate where the puddler is at work is kept very cool. The working of the furnace appeared to be such that it could not be otherwise than satisfactory, whilst the temperature alone ought to be a sufficient inducement for the puddlers to give the invention their hearty good wishes.

One of the specialities now being produced at the Parkgate Works consists of a puddled steel-headed rail, which for tenacity and durability is said to be fully equal to the Bessemer. It has been brought out by Mr. J. Richards, the able and enterprising manager of the works. It is made of the best pig-iron, and the steel prepared by a process peculiar to that gentleman. Some years since, when Mr. Richards was managing the Round Oaks Works, belonging to Earl Dudley, he made some rails on a similar principle to those now being constructed, and they were put down on the line near to Crewe. They were tested and found to be all that could be desired, so far as regards their wearing properties. Recently the attention of some of engineers of one or two of the leading railway companies was drawn by some means to the old rail, and the result has been that Mr. Richards has received some considerable orders for them. Some specimens shown to us by Mr. Richards, and which had been tested in almost every way, clearly demonstrated the fact that they would stand almost any strain. They could be bent, but unlike the Bessemer, could not be broken. The material would double up or might be twisted into any form. It was very hard, and the fibre was of a fine crystalline character. The rails named, like those made of Bessemer, are well adapted for those portions of railways where the traffic going over them is very heavy, owing to the length of time they will last. On some of the principal lines where something like 15,000 tons of rails are put down annually a saving of about 2*l.* per ton would be effected as compared with the Bessemer rail. Some fine specimens of the material were shown to us, which had been ordered by the Ottoman Government. There is, therefore, every ground to believe that the rail, for which at present there are some large orders in hand, will meet with considerable support from both home and foreign railway companies, when its quality and value have been more completely tested.

COLLIERIES IN NORTH DURHAM, THEIR WORKINGS AND MACHINERY—No. IX.

EAST TANFIELD, TANFIELD LEA, SOUTH TANFIELD, AND TANFIELD MOOR COLLIERIES, as described in the Supplement to last week's Journal, are under the ownership of Messrs. James Joicey and Company. At Tanfield Moor and South Tanfield properties the whole series of seams usually found in the Tyne and Wear districts are said to exist, as follows:—

Names in Tanfield district.	Thickness.	Corresponding names in Pelton and Wear district.
1.—Shield row seam	5 ft. 6 in.	Three-quarter seam
2.—Five-quarter seam, including splint 5 in. at bottom	4 8	Five-quarter
3.—Brass Thill seam	4 8	Main coal seam
4.—Hutton seam	6 6	Maudlin seam / Low Main
5.—Main coal, or Low Main	3 8	Hutton seam
6.—Harvey seam	—	Harvey seam
7.—Busty Bank seam—Top coal	2 ft. 6 in.	Busty Bank seam
Band, good fire-clay	0 8	
Coal	0 6	
Band	0 1	
Coal	2 0 = 5 9	
Fire-clay, inferior.		
8.—Brockwell seam—Top coal	2 ft. 0 in.	Brockwell seam
Good fire-clay	1 0	
Bottom coal	2 0 = 5 0	
Fire-clay, inferior.		

A remarkable feature of the Tanfield district is, that the coal seams are all of good coking quality; the lower coals in particular produce coke of pure quality. At Tanfield Moor the No. 4, or Hutton seam, is the prime coal, and now nearly exhausted. Those above it are to a great extent worked. It will be seen by the above list that this seam is formed by the running together of the Maudlin and Low Main seams of Pelton district. In former years, when the seams of coal were worked at isolated and far apart places, the difficulty or inattention in identifying the seams is shown by giving a seam three or four different names in as many different districts; also by giving the name of Hutton to two different seams. This name (originating probably in the Tanfield district) has been adopted for what was supposed to be the same seam in Pelton, but which, by the fuller development of the coal measures, is now proved to be a seam below that, in Tanfield district. At East Tanfield pit the highest coal is the Main coal, those above being denuded. Between this and Tanfield Lea pit, however, a downthrow fault to the west of 50 fms. occurs, which throws in most of the seams on the dip side of the fault.

EAST TANFIELD COLLIERY.—Opened in 1844. Two coal pits sunk 10 yards apart, one 30 fms. in depth to the Main coal, with a special upcast about half a mile distant. The other coal pit is sunk to the Brockwell seam, 78 fms. in depth, intersecting the Busty Bank seam at 60 fms. The upcast for these two mines is about 200 yards distance to the west, sunk to the Busty Bank seam, where a furnace is placed. From the Busty Bank and Brockwell seams about 370 tons of coal is raised per day in two-decked cages, two 8-cwt. tubs in each cage, from their respective levels, with a beam winding-engine of 24-in. cylinder, 6-ft. stroke, 10½-ft. cylindrical drum. The main coal winding-engine has 15-in. cylinder, 3 ft. 4 in. stroke, with a beam resting on cast-iron standards, flat hemp-rope, drums 2 ft. in diameter at first lap. The depth to the Main coal is 16 fms.; about 70 tons of coal raised per day with single-tub cages. The pump-shaft, sunk to the Brockwell seam, is 30 yards from the coal pit. Pumping-engine with single beam, lifting from both ends of it (as described in West Pelton engines), has 34-in. cylinder, 6-ft. stroke; it raises water in two lifts from the depth of 78 fms.; lower lift in the pit is 39 fms., 13-in. bucket, 6-ft. stroke; upper lift in a staple at back of house, 39 fms., 12-in. bucket, 7-ft. stroke. This engine goes day and night, about four strokes per minute. Main and tail-crabs and jack-gin are erected at this and the other pump-shafts, afterwards described. Another pumping-engine is placed at the extreme dip of this property, at Causey, for draining the Main coal seam only. It has one 20-in. horizontal cylinder, 3-ft. stroke, and works a lift of 16 fms., 12-in. bucket, from the end of its shaft by means of a crank and pumping-beam below. Another engine at East Tanfield pit, originally a sinking engine, is now used for hauling laden wagons from the screens up a bank 130 yards in length, to a height sufficient for them to run to the coke ovens by gravity. This engine has one 20-in. horizontal cylinder, 3-ft. stroke, acting direct to jack rope-drum, 5 ft. in diameter, and by wheels in ratio of 1 to 3, gives motion to two 4-ft. drums on one shaft for working this bank. These two drums may be put in or out of gear by a slide carriage, and also by a clutch at the side of each drum. The main rope hauls wagons up the bank by means of a return wheel at the top of it; the tail rope is used merely to pull the main rope back again, as the empty wagons return to the screens by another road. A hauling engine is placed in the Main coal seam, 20 yards from the pit; it has two 16-in. horizontal cylinders, 3-ft. stroke, direct acting, and works an east plane 1400 yards in length, 30 tubs per set, by means of an endless rope. The rope is passed three times over two three-grooved wheels 6 ft. in diameter, similar to a pair of blocks, thence it is passed over another 6-ft. wheel, with balance weight attached to tighten the rope, from thence the rope is taken in the contrary direction to the engine plane. Seven boilers supply the East Tanfield pit engines (including that at Clay mill) with high pressure steam, 27 lbs. pressure; five of these are 30 by 6 ft.; two, 21½ by 5 ft., all uncovered; steam from these is taken down to the underground engine in pipes, the escape steam is brought through the same pit in pipes. The Main coal seam is got on the bord and pillar system; pillars are 30 by 12 yards, more recently they have been made 22 yards square with advantage; bords, 4 yards; walls, 2 yards in width. The pillars in the Busty Bank seam are now made 60 by 30 yards. The Brockwell seam is intended to be got on a system of wide work, combined with large pillars (50 to 100 yards) and narrow work as outlets for the conveyance of coal from the faces of work. No safety-lamps are used.

The whole of the coal raised at East Tanfield is used for coke making. There are 224 coke ovens—one double row at East Tanfield of 80 ovens, with main flue and four chimnies, 45 ft. in height of flue; these are dome-shaped, 10½ ft. in diameter. There are 144 similar ovens at Tanfield Lea supplied with coal from this pit; the ovens are all charged at the doors, and the coke is drawn by rake. Gas-works supply the top of the pit, screens, engine-houses, and clay-mill; it is also taken down the pit; there are 54 gas lights in the Main coal and Busty Bank seams at and near the pit.

In the brickworks common red bricks and pipes are moulded by machinery, surface clay is used. The engine has a 16-in. horizontal cylinder, 2½-ft. stroke. The clay, after passing the pug-mill, is forced through dies by means of two rams, forming 2-in. drain pipes; these come out horizontally, and are afterwards cut by wires. From another horizontal pug-mill the clay for bricks is thrown out by the knives, passes between a pair of rolls, thence through a die, after which the required breadth of brick is cut by wires. Flooring tiles and pantiles are also made, and pressed by separate machines; 12-in. drain pipes are also made by a vertical hand machine.

TANFIELD LEA COLLIERY.—Eight old pits now abandoned have been formerly used for the raising of coal. The present coal pits are two, opened in 1831, 12 yards apart. One 10 ft. in diameter is sunk to the Brass-thill seam, 32 fms. in depth; the other is 11 ft. in diameter, 75 fms. in depth to the Main coal seam, and is divided by wood brattice for pump and coal shafts. The winding-engine for the latter pit is a lever condensing engine, 26-in. cylinder, 5-ft. stroke, 9½-ft. cylindrical drum; one boiler 28½ by 6 ft., 20 lbs. pressure. About 80 tons of coal are raised per day in single-tub cages. The Hutton and Main coal seams are worked; the former is in course of opening out. Pillars 30 by 10 yards. The Hutton seam coal is lowered down to the Main coal by an incline. The Brass-thill winding-engine has one 20-in. horizontal cylinder, 3-ft. stroke, direct-acting, non-condensing; 7½-ft. cylindrical drum, with two boilers 30 by 6 ft., 27 lbs. pressure. About 400 tons of coal are raised per day in single-tub cages from the Five-quarter and Brass-thill seams; the Five-quarter is sent down by incline to the Brass-thill seam. Pillars 22 yards squares. The pumping-engine is a single beam atmospheric and condensing engine, with 68-in. cylinder, 8-ft. stroke, with separate condenser: two boilers 26 by 8 ft., steam at 10 lbs. pressure acting on the under side of the piston. Water is raised in three lifts of 20 fms. each; the lower lift 13-in. bucket, middle 12½-in., top lift 12½-in. bucket. All these are at the outer end of the beam, and 8-ft. stroke. This engine goes eight strokes per minute for 12 hours each day. The upcast pit for Tanfield Lea Mines is an old pit deepened to the Hutton seam, about 400 yards from the coal pits, with furnace at the bottom. The principal workshops for East Tanfield, Tanfield Lea, and Tanfield Moor are here. There is one 10-in. horizontal engine, with boiler 12 by 4 ft., for driving circular saws.

TANFIELD MOOR COLLIERY.—This is the oldest of the four collieries, and mining has been carried on here probably for 200 years. The greater portion of the upper seams is exhausted—that is, those above the Main coal. There are 22 abandoned pits on this property, which were formerly used for raising coal. The present coal pit has been 102 years in use for coal work. Several of the old railways can still be traced, which were used for conveying coal from Tanfield Moor and Tanfield Lea Collieries. One of these passes over the celebrated Tanfield arch, built in 1727, on the route to the Tyne at Teams, where the coal was shipped into keels. Horse traction and wooden rails were used at this date. It may be observed here that wooden rails were first used about the year 1632. Cast-iron rails were introduced about 1794, and wrought-iron rails about the year 1815, in the northern coal field. At the present time coal and coke from the East Tanfield, Tanfield Lea, and Tanfield Moor Collieries are conveyed away for shipment by the Brandling Junction section of the North-Eastern Railway system, which passes near these collieries on its route to Annfield Plane.

The Shield Row seam only is now got at Tanfield Moor Pit; the depth to this seam is 30 fms.; about 700 tons of coal is raised per day, in two-decked cages, two 8-cwt. tubs in each cage. Lever winding-engine, of 26-in. cylinder, 5-ft. stroke, 9½ ft. cylindrical drum; two boilers, 28 by 6 ft., and two 24½ by 6 ft.; 27 lbs. pressure of steam. Boiler-feeder 9-in. inverted cylinder, 6-in. ram, 10-in. stroke; the boilers are usually fed by the winding-engine, and the small engine is in reserve for this purpose. The Tanfield Moor pumping-engine is placed about 800 yards eastward of the coal pit. This engine has an open-topped cylinder, and is one of Newcomen's principle, being regarded now as a curiosity; the steam is condensed in the cylinder under the piston; the cylinder is 48 in. in diameter, 7-ft. stroke; it has been in action here 98 years, and was used at North Biddick Colliery for 18 years previous; made in 1754, it only ceased working six months ago. There are two haystack boilers to supply it with steam, at 5 lbs. pressure; these are each fed by a vertical pipe and kettle at the top, with a valve regulated by the float, and according to the height of water in the boiler. In case of undue pressure the water would be blown out at the top of the pipe. The boilers and pipes are roofed over, which prevents the action of frost in the pipes. This is considered a safe method of feeding, and might be applied with advantage in higher pressures. Many of these old boilers may be easily pierced with a knife; the incrustation on the inside, formed by long use, becomes the strongest part of them. Water was raised in two lifts by this engine, from the outer end of the beam—the lower lift is 14 fms., 13-in. bucket; upper lift, 20 fms., 12½-in. bucket, delivering to an adit 27 fms. below the surface; depth of pit, 61 fms. Since the stoppage of this engine the water has been allowed to accumulate, until it flows over to the Tanfield Lea engine. The first engine erected on Newcomen's principle was at Oxclose, another at Norwood, and the third at Byker, in 1714. In the year 1769 there were 99 of Newcomen's engines used in raising water from mines in the northern coal field, the largest of which was at Benwell Colliery, with 75-in. cylinder.

A hauling-engine is placed in the Brass Hill seam, at Tanfield Moor, but is now out of use, as that seam is not at present worked. The engine has two 16-inch horizontal cylinders, 3-ft. stroke, wheels in ratio of 1 to 3; cylinders about 5 ft. apart at their centres. One drum is placed on each side of the engines, 4 ft. in diameter, 2 ft. wide, on separate shafts, with slide carriages, for main and tail ropes, which are used throughout the plane. The engine is placed 70 yards south-west from the pit; the engine-plane is 1600 yards in length, south-west and south in direction, undulating in gradient; at 1200 yards inbye a branch of 250 yards to the east takes off; 44 tubs are run with each set. Steam is brought from the surface boilers, and the escape steam is taken up the pit again in pipes. The upcast and furnace for Tanfield Moor Mines is about 400 yards from the coal pit. Forty coke ovens are erected at Tanfield Moor, resembling those at East Tanfield, with main flue and two chimnies. The Shield-row coal is used, which produces a hard description of coke.

SOUTH TANFIELD COLLIERY.—Opened in 1837. This property at that period had been untouched. There is one coal pit 10 ft. in diameter, sunk to the Brass-thill seam, 50 fms. in depth; a portion of this is partitioned off for the pumps. Beam winding-engine has 22-inch cylinder, 5-ft. stroke, 9-ft. cylindrical drum; about 450 tons of coal raised per day from the Shield Row and Brass-thill seams, in two-decked cages, two 8-cwt. tubs in each cage. The upcast pit and furnace is 80 yards distant from the coal pit. The pumping-engine, single beam, 30-inch open top cylinder, 4-ft. stroke, with condenser separate, raises water in two lifts at the outer end of the beam; lower lift 25 fms., 9½-in. bucket; upper lift 25 fms., 10½-in. bucket, 4-ft. stroke. The engine makes seven strokes per minute, 12 hours in the day. The back of the beam is weighted, 25 lbs. steam pressure is used under the piston. Another coal pit is being sunk to the Hutton seam, 20 yards distant from the former, 10 ft. in diameter; its present depth is 70 fms. A lever winding-engine, erected in 1870 by J. and G. Joicey and Co., Newcastle-on-Tyne, has 28-in. cylinder, 5-ft. stroke, 11½-ft. cylindrical drum. Four plain boilers, 30 by 6 ft., one 27½ by 6 ft., one 29 by 6 ft., supply these engines with steam at 30 lbs. pressure. The sinking engine has a 12-in. horizontal engine, 2½-ft. stroke; wheels in ratio of 1 to 3, one 4-ft. drum, and a tubular boiler near it. There are the usual workshops here, and one 12-in. horizontal engine to drive the circular saws. Fire-bricks are made of good quality from the fire-clay under the Brass-thill seam. The clay mill, consisting of one pair of stones, elevator, riddle, and pug-mill, is driven by a 14-in. lever engine, 3-ft. stroke. About 5000 bricks are moulded per day. Five kilns, each contain about 7000 bricks, have each three fires in front, and a chimney. There are 73 coke-ovens erected here, dome-shaped, 10 and 11 ft. in diameter; these utilise the whole of the small coal produced by screening. These ovens are also provided with main flues and chimneys. The coal and coke is conveyed away from this colliery by the Stanhope and Tyne Railway for shipment. This railway was opened 40 years ago, and is extended also to Annfield Plane, receiving traffic from a large number of collieries in its route.

THE EXPORT COAL TRADE.—The exports of coal from the United Kingdom in January showed a considerable falling off, having been only 559,690 tons, as compared with 758,614 tons in January, 1870, and 634,968 tons in January, 1869. The exports to France showed a great diminution—a diminution which accounted to a great extent for the decline which the exports generally presented. Thus we sent the French in January only 105,677 tons of coal, as compared with 191,279 tons in January, 1870, and 168,978 tons in January, 1869. The exports of coal increased in January to Russia, Brazil, and India; but they seem to have decreased in almost every other direction. The value of the coal exported in January was 280,671*l.*, as compared with 369,507*l.* in January, 1870, and 322,621*l.* in January, 1869. In these totals France figured for 47,341*l.*, 83,682*l.*, and 76,429*l.*

BOARDS OF CONCILIATION BETWEEN EMPLOYERS AND EMPLOYED.

Mr. RUPERT KETTLE and those other members of the Social Science Association, who are laudably anxious to see an end of all open strife between men and masters, believe that the time has arrived when arguments upon the laws governing the productive operations of labour and capital should bring forth some working result. Hence, Mr. KETTLE had no objection to speak, and the rest to listen and debate, on the 30th of last month, when there was a sessional sitting, to discuss the very important topic. The Society for Promoting the Amendment of the Law is united with the Social Science Association, and the question was one of especial interest to lawyers, for Mr. KETTLE, himself a barrister, proposed not only to give his mature views upon the whole subject, but likewise to show what was required to give the boards further success. Lawyers, as well as men of business, were, therefore, amongst the 28 gentlemen who were present. The fact is noteworthy, because of the upshot of the meeting. This was a resolution requesting the Council of the Association to procure the insertion, in any Bill before Parliament, next session, clauses to secure for modern boards of arbitration, formed to settle trade disputes, the provisions of the Act of Geo. IV., c. 96, or to provide some other means for enforcing the attendance of parties and witnesses, and the production of books, papers, and documents before such boards, and for the enforcement of awards made by the boards. If this course should be pursued, and such a clause become law, then dignity and certainty will be imparted to arbitration to an extent that does not now characterise its proceedings. It may be true, as indeed was urged, that arbitration can be enforced at Common Law, before one master and one man, and it might, therefore, seem difficult to men without experience in such matters to understand why, with almost equal ease, it could not be enforced when there were six masters and sixty men. To this the practical difficulty is that the men, as it was pointed out, are worth nothing, and that to enforce an award against them might be altogether useless, for they would have nothing to lose. With the general adoption of arbitration, however, a much more forcible remedy might be secured, to the extent of distraint, or even arrest. The point is of much significance, because it is the want of the ability to effectually enforce awards that is retarding the progress of the principle of arbitration. No small indication of its necessity is found in the fact that it was to this point that the proposition of Mr. KETTLE led up. If, therefore, such an additional power has seemed necessary to him, with all his experience, that fact is of itself a powerful appeal in its favour. Further, its source is conclusive as to the effect which it will have upon the principle of arbitration. A man who has spent the best years of his life in assisting to bring arbitration to the point at which it stands, would not now advocate aught but what it may be confidently inferred will tend to its consolidation. We hope that the resolution will have legal embodiment in an early Act of Parliament.

Meantime, let employers and employed together who have not yet adopted conciliation and arbitration, or other methods, such as partnerships of industry, of preventing ruinous hostility, reflect upon the indisputably economical method which arbitration presents of adjusting differences that must now and again inevitably arise. Employers and employed take up a false position whenever they imagine that employment is other than a matter of bargain and sale. Mr. KETTLE reminds us that the Communist would say that the workman is entitled to that which is reasonably sufficient to supply his natural wants in exchange, "because he is a man and a citizen." The Humanitarian comes in and says, he is so entitled "because he is a man and a brother." Whilst the arbitrator, on the contrary, in estimating the exchangeable value of the man's labour persists in saying that he is entitled to so much "because he is a blacksmith, because he is a weaver, because he is a carpenter." Nor does he believe that any alteration in the conventional form of bargaining is required between the buyer and seller of unskilled labour. The influences which in this old society, and around the ever-increasing group of unskilled men, and by which the conditions of the employment are determined, are in Mr. KETTLE'S view far beyond the reach of any board of arbitration. Politics and sentiment, socialism and philanthropy, must all be eliminated from this question. It can be discussed only upon the principles of the Economist. This man lays it down that a fair day's wages is the price which the day's labour would then and there bring in the open market. In such a view Mr. KETTLE heartily concurs; and it is because his experience has taught him that in boards of conciliation and arbitration we have the only real open market for skilled labour that he advocates their establishment. He seeks to make them a labour mart in which upon particular days the buyers and sellers may meet in separate groups, and having considered the *pros* and *cons* of present value, afterwards join together to determine by discussion the price of the day. By this means the resulting mean price would be arrived at, in the fixing of which the judgment and the information of the dealers would have contributed. There would, in fact, be all the effect of individual competition brought out in one general result. Having in these negociations settled the market price of labour, and agreed upon a contract, the parties, Mr. KETTLE very correctly urges, may in most industries fairly buy and sell, not for to-day only, but likewise for to-morrow. Upon this point he speaks as last week we hinted he had spoken in connection with the most recent labour disorganisation, in which our readers are interested:—

"Although this subject of fixing a future rate of wages is a matter of substance rather than that of form, which I am now upon, I take the liberty of saying a few words upon it, because it not only involves one of the master fallacies we have to contend with in establishing boards of arbitration, but is pressed upon our attention at the present time by the sad state of things existing in the iron manufacturing districts of Scotland. I speak of this from reports in newspapers only, and without any personal knowledge of the facts. It seems, then, that a dispute arose in the autumn of last year as to the scale of wages in the trade. This was referred to Mr. ANDERSON, the member for Glasgow; the men in the meantime to go on working, subject to a back reckoning to be had upon the basis of his award. After a long and patient investigation, an award was made which determined what the men should be paid for current work, and for that which had been done pending the settlement by arbitration. The umpire does not appear, so far as I can learn, to have been asked to decide for how long the awarded rate of wages was to be paid; the masters believing, I am bound to presume, that the facts as to the state of trade had changed since the time to which the evidence before the arbitrator related, gave, soon after the award was published, notice for a reduction. This has led to a strike, and now—whilst we are assembled here—that great trade is losing to employers and workmen money at the rate of at least 30,000*l.* for every week the strike lasts."

To limit workmen to the selling of their labour retail in parcels of a week would in modern times, Mr. KETTLE urges, be as unfair as bringing back the dealers in other commodities to the antiquated system of a "pitched" market. Wages transactions between masters and men should undoubtedly be regarded, as we last week tried to urge, in relation to their prospective advantages. And we fully agree with Mr. KETTLE when he says:—

"The duty of a board of arbitration does not end with the making of a contract of hiring; it affords important assistance in carrying out that course. Many intelligent persons will think that when an agreement is settled and reduced to writing—a course I advise in all cases—that it will be then quite easy to interpret it. This is, in practice, found not to be so. Even Acts of Parliament, upon the wording of which so much care is bestowed, are often ambiguous, or in the technology of my profession, 'insensible.' Both employer and workmen have confidence in their contracts, when they know there is an impartial and popularly informed tribunal which can be called upon to put upon them a binding interpretation. When minor differences arise, such as do not affect great trade interests—difference often commencing with a personal quarrel be-

tween a workman or body of workmen, and an overlooker or foreman, it is well that some judicious conciliator should step between the disputants, and by authoritative advice prevent these small bickerings growing into a trade strife —a taking of sides to be followed by the proverbial consequences of the letting out of troubled waters. It is, then—1. As an open market, in which the fair wages for a fair day's work can be determined.—2. To prevent misunderstanding as to the meaning of hiring contracts; and 3. To pacify quarrels when they arise in the execution of such contracts, that I think boards of arbitration and conciliation are required."

We nevertheless confess to an earnest wish to see the relations between master and man in the coal and iron trades based upon the co-partnership principle either of Messrs. BRIGGS BROTHERS, or of Messrs. FOX, HEAD, and Co. Our views are the same now as they were when, in the *Mining Journal* of October last year, we wrote upon the debate on this same question at the annual meeting of the Social Science Association, at Newcastle-upon-Tyne. It pleases us much to see that Mr. KETTLE is pretty much of our own opinion. We fully endorse the philosophical and judicious utterances he uses in that respect. He says—

"I have never contended that Boards of Arbitration will prevent—nor do I think it desirable they should prevent—any new form of productive organisation being attempted. Hand workmen may, and I hope will, try various forms from the bonus system of Messrs. FOX, HEAD, and Co. down to co-operation and division in its simplest form. In the end workmen will find that in order to attain their ideal of success they must obtain the capital necessary for conducting modern productive operations. To do this they must begin at the beginning. Capital is the unconsumed product of labour—in common parlance, *savings*. All the rest follows. It is no part of my purpose to-night to trace this out, to show how thrift begets confidence, and that confidence is the father of credit, and that where mutual confidence is established union will in this, as in other cases, give strength. I do not think the present relation of employers and workmen is destined to perpetuity—the line between profits and wages is too hard and too fast. A transition has already begun—we know our point of departure, but at present I, for one, do not clearly see the terminus. Under the present organisation of production I know of no better mode of doing justice alike to employers and workmen than by a Board of Arbitration."

Still we do trust that, in view of the changes that are before us, and remembering the marked success, as well to masters as to men, which has hitherto attended the working of the co-partneries we have mentioned, masters and men will alike look to them as their ultimate aim, even though at present there may not be a few cases in which Boards of Conciliation and Arbitration are the most practicable.

INDUSTRIAL AND TECHNICAL EDUCATION.

SIR,—I have to thank you for the very able article which appeared in the *Mining Journal* on Jan. 14 on the National University, and hope you will permit me at the same time to thank "A. O. F." for his kind and suggestive letter, which you published on the 4th inst. I may also say that I shall be happy at all times to send papers, and, indeed, every information, to such of your readers as take an interest in technical education if they will favour me with their addresses.

For the information of "A. O. F," and others who take an interest in the subject of the degrees to be granted, and the decorations which ought to accompany them, I desire to state that the promoters of the National University have made extensive enquiries into the practice of the German, French, and other technical colleges, and have also some well-matured opinions of their own on the subject. It was, however, thought desirable not to make this a prominent feature in the early programme and reports. The first thing to be ascertained, in their judgment, being does the English nation desire to have a new university, which shall embody and teach the science, art, and literature of the present instead of those of past ages? And if so, from what sources are the funds to be obtained to maintain a vast institution able to minister to the ever-increasing wants of Great Britain and her colonies? When the Royal Charter is obtained, I take it for granted that a body of learned men will be appointed to determine all those matters of detail: a great number of suggestions will be laid before them, not forgetting "A. O. F.'s" excellent letter.

It may, perhaps, interest many of your readers if I state generally what the views of the promoters of the National University are as to the steps to be taken to make the institution a success. It appears to them that the first thing necessary is to make the want of science and art teaching, applied to trades and commerce, felt everywhere; and beyond this, to submit a grand scheme upon which public opinion can be organised. It is taken for granted that in a country so rich as England, and with hundreds of thousands of pounds annually wasted or misapplied, which ought to be devoted to the higher education of those whom our forefathers regarded with so much interest —"poor scholars,"—no difficulty ought to be experienced in regard to funds. It was, therefore, thought best to break boldly with the old universities. Two years before the National University was proposed the following appeared in a parliamentary report:—

The mention of the matriculation examination brings me to superior, or university instruction. This is, in the opinion of the best judges, the weakest part of our whole educational system, and the Commissioners must not hope to improve effectually the secondary school without doing something for the schools above it with which it has an intimate natural connection. The want of the idea of science, of systematic knowledge, is, as I have said again and again, the capital want at this moment of English education and of English life; it is the university or superior school which ought to foster the idea. The university or the superior school ought to provide facilities, after the general education is finished, for the young man to go on in the line where his special aptitudes lead him, be it that of languages and literature, of mathematics, of the natural sciences, of the application of these sciences, or any other line, and follow the studies of this line systematically under first-rate teaching. Our great universities, Oxford and Cambridge, do next to nothing towards this end. . . .

We must get out of our heads all notion of making the mass of students come and reside three years, or two years, or one year, or even one month, at Oxford or Cambridge, which neither suit their circumstances, nor offer them the instruction they want.—(See School Enquiry Commission, 1868, vol. vi., pp. 635-6.)

The first programme issued by the provisional committee says—

Without depreciating the value of any kind of study, the National University will aim at training natural philosophers, artists, chemists, engineers, and mechanics, who shall carry the light of their genius into every home and workshop in the United Kingdom, and will bestow its honours and rewards upon those who shall obtain distinction in the arts and sciences, which have created and must ever sustain our civilisation. Its sphere will be the present, the practical, the useful; and its object the successful cultivation of every art, science, profession, trade, and occupation by which mankind subsists and is rendered happy.

Just at present there is one matter in which your scientific friends can help us very materially. A conference will shortly assemble to discuss the great question of technical education in England. The Lord Mayor has kindly granted the use of the Guildhall and Mansion House for the occasion, and papers are required upon every branch of science and art training. Will some of your scientific readers kindly assist us by reading papers, and, above all, will the *working men* aid us with their thoughts? The following conditions under which papers can be received will shortly be issued:—

Every paper intended to be received at the Conference must be written in conformity with the following conditions:—

1.—It must be special, refer to some one subject, and to that only, except for the sake of illustration.

2.—It must, so far as possible, be *exhaustive*, and treat of the subject in all its relations.

3.—It must be *accurate*. It is desirable to have personal knowledge on all the subjects treated on, and when this cannot be obtained the facts should be taken from undoubted sources, and the authorities given.

4.—The papers must be *brief*. In no case, excepting the address of the president of the section, must the time for reading extend over more than 30 minutes.

5.—It must be remembered that the object of the Conference, as laid down in the report agreed upon at the Mansion House on Oct. 10, is for "considering and adopting the necessary measures for establishing the National University," and that no papers can be received or printed which are not specially directed to *the promotion of technical education in Great Britain:* no time can, therefore, be devoted to the discussion of either "primary" or "classical instruction."

At a meeting of the general committee, held in the Mansion House, Dec. 13, 1870 (the Right Hon. Lord Mayor in the chair), the following general statement of the object of the conference was agreed to:—

In answer to the second question:—The design of the Conference is to elicit the fullest information on the subject of Technical Education in Great Britain as compared with other countries, and hence gentlemen who have made the subject a matter of study, and may, therefore, be reckoned authorities on it, will be invited to contribute papers, and take part in the discussions which may follow. Your executive committee have the fullest confidence that such an amount of information will be elicited by this Conference that its proceedings will be regarded with more than a passing interest, and when condensed and published will form a volume of very great utility. To this end it will be necessary to have full and accurate information on the state of industrial education in England, and what the actual requirements of our trade and commerce are.

First in importance stand the great staple industries of the United Kingdom, which may be enumerated as follows:—Agriculture, mines, and quarries; also the workers of metal, architects and builders; those employed in the production of textile fabrics, in wool, cotton, and silk; and the workers in pottery and glass, as well as the fellmongers, dyers, and others who prepare the raw materials for the manipulations of other trades. Then will come the art workmen possessing special skill, and needing above all others special culture, such as the makers of horological and meteorological instruments, carvers, gilders, and, indeed, all those who pursue the arts which embellish the object of utility and taste which adorn our public and private buildings. Nor must we forget in this enumeration the claims of our maritime population, and hence the technical education of those engaged in shipbuilding, navigation, and fishing will be especially reported on, not only as they are, but also what science and art could do for them in their respective vocations. Neither must our schools and colleges be overlooked, especially those which profess to teach science and art. Thus your committee hope to obtain full and authentic information on these subjects, and in such a form as will lead to direct practical results.

I am afraid, Mr. Editor, that I am trespassing on your space in giving all these details, but the importance of the subject must be my excuse. Our position, as the leading industrial nation of the world, is not only challenged but seriously endangered, and our cry must be that of the German poet and philosopher—"Light, more Light."—*Storey's-gate, St. James's-park.* JOHN MILL.

INDUSTRIAL AND TECHNICAL EDUCATION.

SIR,—The technical education of those entrusted with the superintendence of our manufactures, mines, &c., is a matter, the necessity for which is daily gaining public assent and attention not only among those who are employers or employees, but more significantly forming the serious thought and utterance of our statesmen, which surely points to legislative action to make it obligatory at no distant date. The importance of scientific training, combined with practical experience, to the successful prosecution of any industry, is so obvious, that the bare mention of the allied acquirements being possessed by any individual, at once suggests the idea of capabilities that, other things being equal, should ensure the greatest possible success. Without at present enquiring into the reason why it is notoriously true that the mining interest, of all other callings, is the most deficient in that accurate knowledge which, having regard to the magnitude of the pecuniary interests at stake, and most especially the peril to life and limb involved, would naturally be expected to be found, if anywhere, greatest in mining practice. The chemist and mechanician have each contributed largely of their time and skill to the safety of life, and material furtherance of the mining interest; but though past beneficial advancement is not to be despised, the frequency and appalling character of the catastrophes destructive to life from gas in our coal mines, and the large total of fatalities from other preventible causes in both coal and iron mines alike, testify most unmistakably to the great further need of improved knowledge and training, to lessen, if not remove wholly, the loss of life, much of it traceable to present managerial incompetency.

The metalliferous department of British mining—meaning by that phrase the raising of the ores of tin, lead, copper, &c.—although happily free from noxious gas, and rarely the scene of accident, is unfortunately devoid of the profitable universality characteristic of the staples before referred to. The capital embarked in metallic mining in our midst is, however, by no means inconsiderable, and I believe, increasing. The field is large—I might say inexhaustible—and certainly we are not without the most tangible evidences of its profitableness in every district of our country where it is in active progress. At once setting aside, as unworthy of consideration, the large number of mines organised and worked with other than a legitimate end in view, I fear we must ascribe the mining failures, and attendant loss of money and confidence, more to defective skill, and the application of it, than the ever-ready plea of paucity of the ores which are the object of search. There is no calling among us that has been so barren of scientific research or recorded experience; and as a consequence, it must be admitted that there is little really definite, and a great deal too much hollow pretension, to the increasing prevalence of which much of the unsatisfactory public sentiment regarding the pursuit is due.

The claim to pronounce authoritatively as to the value or otherwise of any mine or mining sett, after a superficial inspection of a few hours, is assuredly a feat which can hardly be looked for from everyone; and though procedure founded on such a dictum may at times prove appropriate, chance is, perhaps, more to be credited with the result than any scientific acumen. Looking at the greater success of mines worked by operative miners, devoid alike of capital and technical knowledge, over concerns (often on the same ground) lavishly supplied with all the resources that money can furnish, it would seem that this by no means unfrequent fact, while conclusive as to the almost general paying character of metallic mining, even simply but honestly gone about, would also point to some serious and fatal defect in the adaptation of means of regulation of labour in those places where such an anomaly prevails. The ability to attend to and regulate, in a systematic manner, the multifarious, and in an economical sense, important duties devolving on those entrusted with the charge of very many metalliferous mines, is without doubt wanting; and this may be conceded, without prejudice, to those who are doing their best to discharge the unsuitable duties which an unthinking direction expect from them. Restricted to their specific work, one can believe that they will feel at home, and be more likely to accomplish it with credit to themselves and profit to their employers. To descend from science to common sense, disappointment must and will (except in rare instances, where a natural inherent aptitude is shown for handling men efficiently) follow the very frequent custom, especially in our Northern mines, of expecting from operative miners a general mechanical knowledge and commercial fitness to fulfil duties they are unfitted for by habits, training, and education. Besides, it must be remembered that there must cling to them, more or less, the habits and associations of their past station, detrimental to their business dealings with the class from whence they sprung, but much more intensified in those cases where they are raised from among their fellow-workmen to full authority over mines in their own district, often showing personal pique on the one hand, and snug family and neighbourly arrangements on the other, rendering shareholders' interests a secondary, indeed, quite subsidiary, consideration.

The truth is, the retrogressive career of many mines, in spite of reiterated and unanimous testimony to their profitable past and should be present, is owing less to technical training than to disregard of the simplest business procedure in the labour organisation. Instead of always resorting to mine inspection when there is a hitch to progress, it would be well for those interested to try and solve the seeming enigma themselves, as, misleading statements notwithstanding, I will boldly affirm that in the majority of cases it is the system of working, not the poverty of the mine, that is at fault. Engrossed by more pressing duties, it is unfortunately the fact that this necessary attention can rarely be bestowed. In such circumstances, the necessity of having a representative fully qualified to exercise a general supervision, energetic, and free from local influences, is undoubted. In fine, let more care be exercised in metallic mining to secure individuals for managers entirely devoted to the interests of shareholders, and I have little fear but that mining success, instead of being, as now, the exception, will prove the rule henceforth. CUMBRIAN.

Feb. 13.

NEW STEAM ORE-STAMPER.

SIR,—If your correspondent, J. Sturgeon, in his reply had confined himself simply to the endeavour to controvert my statement, instead of indulging himself in the distortion of facts, and drawing conclusions therefrom favourable to his purposes, I would not have troubled you with any further remarks, but such statements cannot be permitted circulation without challenge. Firstly, I must unequivocally repeat my former communication as being the real truth in its entirety, if not the whole truth, in which I am supported by Capt. Polglase; and I further most emphatically deny that representations as to responsibility were ever made, or that any guaranteed order for 20 ore-crushers was ever given, as stated, as an inducement to the agreement with me. Again, Mr. Sturgeon states that in November, 1869 "we (Messrs. Chatwood and Sturgeon) were then working out our ore-crusher plans," and in January "we showed them our moving cylinder arrangements and details of our invention, which we ourselves had worked out some time before." Here is another distortion of facts. If Mr. Sturgeon's own admissions can be entertained, which were made at Bodmin in the presence of two witnesses, —first, that in my communication to him he gathered that it was for crushing ore, and that until their inspection of the Wheal Mulberry stamps they had no idea what it was our desire to supersede. The details of their matured invention, as shown to us, consisted merely of the ordinary "Condie steam-hammer," whilst they were furnished with special working drawings in detail of the "cofer" grateway, "ore shoot," &c., which they have not abandoned, as their illustration in the *Engineer* of Jan. 6 fully proves. Mr. Sturgeon also professes to believe, and so represents, that the concentration of force into one large stamp-head had not been contemplated by us; whereas that was our speciality of the invention, and at Bodmin this was fully discussed, and our estimate that one head would be equal to 100 ordinary stamp-heads, and both Chatwood and Sturgeon were furnished with other estimates of working results, based upon that data. Mr. Sturgeon then amuses himself, and offers the same felicity to your readers, by discussing the blunders in our provisional specification, which both Chatwood and Sturgeon very well knew was not our original draft at all, and indeed, that that was the cause of my special desire to supersede it by filing a complete specification, which I was only prevented from doing by those gentlemen, as before mentioned. With all deference to the superior ability of your correspondent, and his partner Mr. Chatwood, it is, nevertheless, absurdly arrogant for mere novices in mining mechanics to ridicule the production of well-known practical engineers, who have been cradled amongst stamps, and I may add that I have crushed ore under a Nasmythe long before Isham Bagga's invention, or Chatwood or Sturgeon were known to fame. WM. SYNNOCK.

27, *Leadenhall-street, London, Feb.* 15.

THE QUICKSILVER MINES OF ALMADEN, SPAIN

SIR,—Among the many mining districts which I inspected during a tour of five months in the late year, I paid special attention to the above celebrated mines, and I have no doubt that all the data I have collected will be read with interest by your many subscribers. My letters will be classified into four different heads—their History, Mining, Metallurgy, and Geology.

The word Almaden is derived from two Arabic words, which signify the "Mine of Quicksilver," but these mines were worked by the Romans many centuries before the conquest of Spain by the Moors. Four centuries before the Christian era Theofrastus speaks of the hard arenaceous cinnabar imported from Spain. In the time of Julius and Augustus Cæsar cinnabar was imported into Rome from the Sisaponæ Cetobrix region (so called by Pliny), the present confines of La Mancha, Estremadura, and Andulusia. Vitrubius also mentions that the raw mineral was imported into Rome, and points out the locality where the distillation was then carried on.

According to Pliny, only 10,000 lbs. of mineral were distilled every year in Rome, and it was calculated that other places in the empire were provided likewise with cinnabar from Spain to about the same amount. It will be seen, then, that it would have taken the Romans about a century to consume the present yearly extraction. Nothing is known, nor do any documents exist, relative to these mines during the domination of the Goths in Spain. The Moors worked these mines, and appear to have been the first who distilled the mineral on the spot, employing it in their chemical laboratories of Cordova. The extraction of mineral, however, did not increase until 1525, when these mines were rented from the Spanish Government by two German mining engineers, Mark and Christopher Fuggar, who employed German miners, and it was then for the first time that a proper system and order in the workings was carried out. These two brothers realised such princely fortunes from these mines that it became a proverb to say, "as rich as the Fuggars," and a street exists to this day in Madrid with their name. The yearly production increased considerably, in consequence of the discovery of the amalgamation of silver ores in Mexico in 1566 by Bartolome de Medina, at the mines of the Real del Monte, and it rose to about 600,000 lbs. of quicksilver per year.

In the year 1752 William Bowles (the first Englishman who visited these mines) received orders from the Spanish Government to inspect them, and he made many improvements in the distillation of the ore, as likewise a better system of working the mines. Here we have one of the many instances of English pluck and energy, carrying science and knowledge into far distant climes. I may also here mention another extraordinary case. In 1728 Lady Mary Herbert, daughter of the Marquis of Powis, arrived at Madrid from Paris, and by her acquaintance with the famous Mr. Law had improved her talents and natural genius for enterprise. She made proposals to the Spanish Government for draining the famous silver mine of Guadalcanal; these were accepted. Lady Mary set out for the mines; in this expedition she was attended by Mr. Joseph Gage. She procured engines from England, as well as miners, engaging her own fortune therein, as also that of Mr. Gage. Considering the great difficulty of travelling in those days—the non-existence of roads—this lady's pluck and energy were most astonishing. It is a pity they are not admitted into some of the foreign mining boards; however, this may yet come to pass, as I see already letters conjointly addressed to them, and one especially by Mr. George Batters, on the Pacific Mining Company's affairs. About this time the production increased to 1,800,000 lbs., which amount was annually supplied to Mexico and Peru for the amalgamation of their silver and gold ores, and it has continued about the same to the present day, with an interruption of some four years during the French invasion of the Peninsula. The amount produced last year was about 2,200,000 lbs., upon which the Spanish Government make 250,000*l.*, and this has been about the average profit for the last century and a half. HENRY SEWELL.

Blomfield-street, Upper Westbourne-terrace.

MINING IN NEVADA.

SIR,—In Capt. Frank Evans's letter of Jan. 21, in answer to mine published in the Journal of Jan. 7, he says:—

It is true I was selected to report and advise upon the purchase of Bateman's Eureka, or Buckeye and Champion Mines, and for that purpose I arrived at Eureka on March 18 last. I was accompanied in the inspection by *two* mine agents, and not one as stated in the said letter. We found the mines comparatively poor. In the Buckeye four shafts were sunk, about 10 fms. apart. The ore deposit in three out of four was worked out; in the fourth there was a pipe of ore, 5 ft. in diameter, which consisted of ordinary blue lead ore, and was the richest portion of the mine; this was within 50 ft. of their boundary. We broke a large quantity of stuff from the selected and rich portion of the lode, but the assays were most unsatisfactory. The Champion was a mere surface deposit, and several feet sunk on what was termed the lode proved to be valueless. We were three days inspecting the property, and all three of us were unanimous that it was not worth the money asked for it—50,000*l.*

It is only the more unfortunate for Capt. Evans that two instead of one mine agent accompanied him in his examination of the Champion and Buckeye Mines; for, instead of (as he says) "all three being unanimous that it was not worth the price asked," one of the three, Capt. Scadden, telegraphed from Austin to the Champion Company here, under date of March 29, as follows:—

Inspected Eureka property. Large quantity of ore; property good; buy.

It is not at all likely that Captain Scadden would have sent this despatch to the company if he had been of Capts. Evans and Brown's opinion that the "property was not worth the price asked." In his (Capt. Scadden's) written report to the company he says:—

Acting under your advice of March 15, by telegraph, I visited and made inspection of the Buckeye and Champion Mines, the result of which was wired to you, according to the best of my judgment and the judgment of some of the miners living in the district, with whom I was acquainted, and in whom I could trust. On the claims there are four shafts, the deepest of which is only 75 ft., the others varying from 50 ft. to 75 ft. In three of these shafts is a good, paying lode, averaging from 3 ft. to 10 ft. thick, one-third of which would be lost in dressing. From the size of the lodes, and the yield per ton of the ore, which even now is in sight, I could not do otherwise than report as I did.

Accompanying this report, Capt. Scadden sends a certificate from the assay-office of Stoch and Riotte, at Eureka, giving the average results in silver, gold, and lead of 31 assays of Champion ores, and between 20 and 30 assays of Buckeye ores, as follows:—

Average assay of Champion ores—Silver, $97·00; gold, $36·00; lead, 47 per cent.
" " Buckeye " —Silver, $99·70; gold $52·00; lead, 46 per cent.

The above report, with the certificate of assay, is in strange contradiction with what is said in Captain Evans's letter. He not only says that "we found the mines comparatively poor," but that "the ore deposits in three out of the four (shafts) was worked out, and the assays were most unsatisfactory." If Capt. Evans returned any assays of the ore or bullion to the company I am not aware of it. Of one thing I am, however, certain, and that is that the box of assay apparatus which was provided for him by the company, at an expense of about 25*l.*, to enable him to make his test independent of local assay offices, still remained in the express office at Austin uncalled for when Mr. Julius Allington, one of the directors of the company, arrived there nearly two months thereafter. With the facilities thus provided him by the company for a thorough examination of the ores and bullion it is hard to account for Capt. Evans's dismissal of this important part of his mission by simply saying that "the assays were most unsatisfactory."

Mr. Allington, at my earnest solicitation, visited and examined the Buckeye and Champion Mines, arriving on the ground about sixty days after the examination made by Messrs. Evans and Brown,

having in his hands before leaving England a copy of their unfavourable report, and he with the full facts before him telegraphed on May 25 to Mr. Batters as follows:—

Must have Champion. Property splendid now. Telegraph ten thousand pounds immediately, or lose property. I take my shares.

On June 16 Mr. Allington's written report was received as follows:—

Austin, May 24.—I hope when you have received this despatch you and the rest of my friends will agree that I was justified in sending to-day's telegram. Personally it will make no difference to me if you take the mine or not, as a Californian agent is now waiting to take it, should we hear that you are unable to do so. Whichever party eventually gets it I shall take as large a holding as I can. The result of the assays I shall send you as soon as possible, though I think the most practical test is the first 46 tons of bullion, which realised £48 per ton. The great body of ore varies in quality no more than gravel, and is taken out as easily. I cannot understand why Evans did not assay the ore as instructed. I think it greatly to be regretted that he did not do so. I found the box of implements at the stage office untouched. From 3000*l.* to 5000*l.* capital would be required, and I really think we could do wonders. From the Buckeye claim alone there is about 1600 tons of ore on the dump-piles. Everything that Bateman told us in London is under the mark, except the distance to the railroad, which is 75, instead of 65, miles.

Even this plain and straightforward report from one of the directors of the company was not sufficient to overcome the unfavourable impressions created by Capt. Evans's statements to the company on his return, so to further investigate the matter it was decided by the company that the directors should telegraph to Capt. William Nancarrow to examine the property, and report his opinion by telegraph, and on June 9 the following telegram was received:—

Nancarrow to George Batters:—Bateman's Eureka looking well; indeed, property good.

Capt. Nancarrow's written report was received July 5, from which the following is extracted:—

There has been sunk on the Buckeye part of the mine five or six shafts, and in all the shafts except one there is a good body of ore in the bottom running in width from 2 ft. to 10 ft. In the north part (meaning the Champion lode) there is an open cutting, in which the lode is very large. There are two furnaces on the property, both working well, and which are the best I have yet seen since I came into this part of the country. They are both supplied and kept in full work by from two to four hands breaking ore from the mine, they producing enough to keep both furnaces going—8 tons per furnace per day; thus showing that with an increased number of furnaces a greater quantity of bullion could be obtained per month.

I have thus been explicit in giving the opinions and reports of Capt. Scadden, Mr. Allington, and Capt. Nancarrow (all of which have been more than verified by subsequent development and yield of the property), to show what great injury crude reports by careless and incompetent men can do, not only to a district, but as well to the pockets of their employers. I placed the Champion and Buckeye property to Mr. Batters for 50,000*l.*, the stock of which was all taken up by his immediate friends; but, in opposition to my every endeavour, assisted by the favourable reports of Messrs. Scadden, Allington, and Nancarrow, the counsels of Capts. Brown and Evans prevailed, and by their advise Mr. Batters and the other shareholders in the Champion Company lost a property which was offered to them for 50,000*l.*, which is to-day selling in San Francisco at the rate of 200,000*l.*, and is now paying dividends at the rate of nearly 500 per cent. per annum upon the price at which Mr. Batters and associates were to get the property.

J. E. BOWE.

Palmerston-buildings, E.C.

MINING IN NEVADA—AND IN ENGLAND.

SIR,—As many of your readers are interested pecuniarily in the success of Mining in Nevada, I thought it might not be out of place nor unacceptable to them my addressing a few lines through the medium of your very valuable Journal, on certain peculiarities existing here from those known to exist in England—or at least in Cornwall—so far as my information extends.

It is certainly due to the English capitalist to be apprised of all that affects the success of mining in almost every part of the world, since their indomitable spirit of enterprise identifies them interestedly with all that pertains to it. Nor is it the capitalist alone who is affected by the issue of this enterprise. It underlies the whole economy of Arts, Science, and the Manufactures, and is only circums..edby their extent. These, so to speak, are the periphery, whilst mining is the radiating centre of all progress. The nervous system of mining—to illustrate by figure—permeates and affects more sensibly the vital action of civilisation and civilising influences than almost any other industry—indeed all others are debtors to this for the means of advancement.

The mechanism of the earth appears to my mind far more abstruse than the mechanism of the heavens—that is to say, the mineral kingdom is regulated by laws as profoundly grand in their minutæ and universality as the comprehending and all-containing laws of Astronomy—coeval, co-extensive, and mutually subservient and dependent, and ultimately terminating divergently in the measureless abyss of infinity.

One branch of the terrestrial mechanism to which I refer is regulated by agencies which science has not yet determined, but its sensible indications of local action are the earthquake and the volcano. It is almost appalling in remote times to stand amid the devastations of these agencies, and reflect that the same forces which operated in past times are active now, reducing mountains of adamantine rocks to mere rubbish, and raising others as ponderous from the abyss of earth into the clouds, towering high above the line of perpetual snow, and with the same apparent ease with which an air-bubble is raised on the surface of water, which again collapse or explode, and in a manner sublimely analogous.

As metalliferous deposits generally are comprised in disruptive or immediately contigious rocks, it is natural to conjecture, if facts of observation were wanting, that to a large extent metalliferous deposits must be necessarily effected by the disruptive forces, independently of all chemical actions, whether repellant or attractive. The formation of rocks appears to be regulated by chemical affinity, whilst their crystallisation is no less evidently the result of igneous electrical action. But to what extent electricity contributes as a motive force to chemical affinity may be better conceived than expressed, at least so far as I am concerned.

The chemical condition of rocks is that primarily on which the success of mining depends, in a general sense, whilst in a limited or special degree the mechanical is no less important; indeed, it would be difficult to conceive of either agency operating independently of the other. From the regularity which prevails in the geology of Cornwall, it would be difficult to realise to what an extent the disruptive forces locally affects the success of mining. Mountains which were one at the time of upheaval, are rent asunder and divided by wide intervening channels, by embryonic mountains, struggling for egress at the earth's surface from depths exceeding the ponderous superincumbent masses, which were destined to become the sport of a once latent but now superior or active energy. Lodes formed under the antecedent condition of things share the fate of the mountains in which they were formed, and their separate sections retire from each other, to occupy in juxtaposition the crests of deep mountain gorges. Embarrassment inseparable from an abrupt introduction to the unfolding of such a leaf of Nature's book, and which presents nothing to many individuals but uninterrupted hieroglyphics, must of necessity give rise to theories of greater or lesser import and value until the characters comprising such roll are deciphered and read in harmony with all their surroundings.

We have no parallel in England that I am aware of for occurrences which are common here, and which no doubt arises from the mountainous character of this country, and the volcanic agencies which have been in operation. The affirmation of English geologists that their own beautiful isle is an epitome of the world's geology do not for a moment invalidate the statement I have advanced; the latter may be true without in the least affecting the former, as the scale upon which Nature operates is gradient from nothing to infinity. Displacements, the results of subterranean agencies, are here abrupt, precipitous, and sometimes fantastical in contour, and constitute a striking contrast rather than comparison with anything prevailing in England on a prominent or even noticeable scale. To indulge in figure—the struggle in Nature has been immense, ponderous masses have been split with an ease apparently as great as that with which a piece of knotless deal is separated by a wedge of sufficient dimensions impelled by resistless pressure, but always, of course, inverted, driven upwards in Nature's handiwork. In contemplation of such scenes the mind involuntarily reverts to the period when the forces which produced such effects were active—not that they are in abeyance now, but have merely ceased to be local—and would fain pourtray in imagination the scene, and luxuriate enthusiastically in the ideal, with mingled wonder and admiration. That success in mining depends on sundry but certain conditions in Nature is a fact that no one now who values his reputation as a miner would have the temerity to oppose, for it is generally admitted that not only are rocks of a specific class indispensable to metalliferous deposits, and therefore to success in mining, but their position relatively to other contiguous rocks, as well as to regularity of individual internal structure of the prolific rocks themselves, are matters of incalculable importance, affecting the extent, quality, and practical value, commercially, of metalliferous deposits. The day is fast waning when that despicable shroud of ignorance—"Where it is, there it is"—will suffice for any other purpose than to indicate its own identity, darkness, and incompatibility with the march of events and progress of the age, something very different from the dogmatical expressions of opinion—so-called—which, when founded upon nothing better than its own assumptions, degenerates into veritable "guess," or vague or idle fancy. The issue depending requires a solid basis upon which to act, and no knowledge which does not include that of the physical laws prevailing in this department of Nature's domain will suffice or be tolerated. To draw a line, however, with anything like geometrical precision between the spurious and genuine in mining will not, we presume, ever be possible, but approximately it may be so, and that is the standard, unattainable though it may be, to which all aim should be directed.

Ellsworth, Nye Co., Nevada, Jan. 19. ROBERT KNAPP.

MINING IN FLINTSHIRE.

SIR,—May I claim insertion in the Journal, at all times open to suggestions for the progress and success of mining investments, for the few cursory observations on mining in Flintshire which follow, with a view to stimulate enterprise in this quarter, and to encourage that already yielding the most sanguine hopes which are yet not unjustified by facts. These remarks may also possibly command the greater confidence from the assurance that they are not merely the result of a superficial acquaintance with the district, but having known it intimately for many years, both in periods of depression and comparative prosperity, I can with the less diffidence lay them before your readers, and even proclaim my belief in the practicability of making mining speculations in this district not much more precarious, and certainly in the long run infinitely more remunerative, than many which, professing to guarantee large rates of interest, frequently captivate the public. For other districts, with which I have only a slight acquaintance, I would not have the assurance to speak thus.

Prefacing my remarks, I must express the satisfaction which all must have felt who at the time condemned the too reckless expenditure of capital in reviving mines of great historic renown—unfortunately their sole recommendation—at the scepticism and distrust which after their failure seized the minds of the too confiding, yet thoughtless, adventurers, teaching them to dogmatise in a rather remarkable manner. This has been evinced expressly for two reasons; first, because this scepticism has evidently had the effect of introducing more of that class of capitalists who come to this investment in the supreme possession of practical common sense; and, secondly, which is of no less importance, because unscrupulous promoters of mining concerns required that check, in the all but universal distrust, to teach them at last that their true interests are identical with the success of their mining and not of their marked operations. It is a subject of regret that mining has also been brought into some disrepute from the circumstance that the opinions chiefly of outsiders have been sought to float much mining enterprise in this county, and also to manage and conduct it, regardless of the weighty probabilities that such testimony may lack sincerity as it certainly does experience or knowledge of the district. I feel that this will not be too severe a censure to pass upon those who, aware of their own ignorance, presume to arrogate for their opinions an importance or influence which they utterly lack. It is astonishing that so much capital has been influenced thus only, as an inevitable result, to be actually wasted. Perhaps not a county in the Principality has suffered more from the repeated failures, nearly always the result of reckless, unthinking expenditure, than Flintshire, though probably few have such indisputable claims to a bold acknowledgment of the *bona fide* character and splendid prospects of this investment when sensibly undertaken. One of the acknowledged good results of the failure of so many quicksand schemes of late years have been to ostracize from the county most of the possibly ignorant promoters, who have apparently been quite satisfied with their experiments. Fortunately there are now fewer quicksand mines promoted, and some most promising setts are being explored by gentlemen who have seemingly enquired into their merits for themselves. And in future I would impress upon capitalists the urgent necessity of ascertaining the value and prospects of their mining investments from self-observation, or if this be impossible, even from the common underground worker of the locality, rather than from the reports of outsiders, however, influential and valuable their opinions confessedly are when confined within the limits of their district, or to the extent of their actual knowledge. For the guidance of those who invest their capital in mining speculations, it is my present purpose to inform them of a few facts in connection with the history of mining in Flintshire, which I trust will be of value to them, as indicative of the true object of their efforts in the future to the more certain attainment of success. Presuming that the stratification and geology of the county are not quite unknown to them, I would first mention the fact, proved so conclusively by the unfortunate failure of so many experiments, that it will not pay to revive old mines requiring the aid of powerful and costly machinery for unwatering, such mines having been formerly exhausted of immense riches, so as to have acquired some of the historic repute already mentioned. In this the wisdom which induced the original investors to abandon these mines when further profitable working could not be shown, may be entirely relied upon, the value of modern improvements in machinery, the former low price of the metal, &c., notwithstanding, as these considerations are more than balanced by the too glaring disadvantages.

Another important fact which it is essential to keep in view in the prosecution of mining enterprise in this district is, that all those magnificent bodies of ore of astonishing richness and extent, which have been the El Dorado of so many, have been discovered almost invariably in those lodes which, as it is provincially stated, "have their noses in the coal measures"—*i. e.*, in the position where these measures overlap the carboniferous limestone or chert, and that no great lasting bodies have been found at the outcrop of this limestone, the ore in this position being generally dispersed through the vein in small, scattered bodies, which have not been at all enormously remunerative in the working. It was in the former position that the celebrated Mold mines, Pant-y-Go, Halkyn, St. George's, Herward, Milwr, and many others almost too numerous to mention, made their great bodies of ore. With these facts before us, I think it will not be wrong to conclude that mining enterprise will not pay at the outcrop of the measures, and that, consequently, trials with the prospect of achieving any great success must be made at the junction of the limestone or chert formations. Whatever may have been their action on the metalliferous deposits, the presence of the coal measures seems to be one of the essentials of a grand success. To this it may be objected that such trials will necessarily be costly, inasmuch as in this position steam-power will inevitably be required, for the purpose of unwatering, and speaking generally, this must be granted; but it is also an indisputable fact that nearly all the great mines have been able to supply this requisite from profits accruing ere the water-level had been reached. The latest instance of this I would offer is Rhosesmor. And even were this not the case, I would ask—is it not infinitely more sensible to boldly supply 1000*l.* or 2000*l.* to meet this contingency, than to uselessly fritter away hundreds here and there, till they amount to tens of thousands? Yet another circumstance, which should not escape notice, is that not a single great lode, which has been fairly tried, under the geological conditions stated above, ever failed to turn out an immense success to the enterprising adventurers; and this statement, which is not alone the result of my own observation, but rather the confirmation of it from repeated enquiries in various directions, I present with every degree of confidence. I would, consequently, declare it as an almost demonstrable theorem, that if only mining in this county is conducted intelligently, taking into consideration the only too palpable causes of past failures, which may in future be avoided, and those conditions of stratification, &c., the invariable characteristics of the great successes, there is no investment in the country which can offer greater inducements to capitalists. It is, therefore, in the thorough conviction of the truth of this that I now present to those gentlemen the foregoing facts—mainly the fruits of the experience and observation of practical miners of the district, to which I merely give expression, in the hope that they will not only be beneficial to themselves, but to the future course of mining enterprise in the county. Amongst the mines which have been lately started, many now could be mentioned which answer the conditions, the chief of which I have just stated, and which, in the choice of mining setts, should never be disregarded. And it were needless to state the merits of some few, as the Vron Gelly, Great Rhosesmor, North Hendra, Vron United, Henblas, Golsen Grove, and Parys Mine, which have now for some time attracted the favourable attention of the public. If the presence of water in the Great Rhosesmor be now the main difficulty to master, I trust it will not long be so, and that the anticipations of the directors will be realised, without resort to further power, or the slow process of draining by adit levels. The shareholders of the Vron United Mine may also be assured that upon the completion of the pumping-machinery requisite to prosecute the discoveries made, which have taken this mine out of the category of uncertain speculations, their property will become rapidly enhanced in value, and be not inferior to some of the best mines in the district. The constant flow of capital into the county will, doubtlessly ere long, bring into prominence the great extent of fresh, unexplored ground now remaining neglected along the line of the coal measures and limestone, and in some parts of which the certainty of success is so amply guaranteed by previous history of geological formation, were only the main obstacle—water, boldly and vigorously coped with.

In speaking of the mineral resources of Flintshire, it is almost needless to enlarge upon its wealth in coal, neither should it escape the notice of capitalists that the spirited enterprise of winning the undoubted wealth of this raw material, existing under the estuary of the Dee, now prosecuted with undaunted energy, promises soon to make this an unequalled field for investment both in its coal and lead mining industries. With facilities for transit by railway, which it already possesses in an eminent degree, and in the rapid approach of the channel of the Dee to this side, bids fair to possess, unsurpassed by sea, I must claim, indeed, for the future of Flintshire an importance also in its smelting and manufacturing industry, unrivalled in any former period of its history, however brilliant this has admittedly been. Especially is it conspicuously marked out as the centre of the zinc trade in the future, the efforts of this industry not having yet grasped fully the unequalled advantages of position, &c., which it offers.—*Flookersbrook, Chester.* FRANCIS FRANCIS.

MINING AS A LEGITIMATE INVESTMENT.

SIR,—Following my observations upon legitimate operations in the working of mines, and legitimate investment, addressed to you last week, I will now call the attention of your readers to some of the most important features of legitimate mining operations.

During the last 10 or 15 years it has become a custom among promoters and committees to introduce as managers of mines their own particular friends, of course with some ostensible pretensions on their part for the office to which they were designated, but really irrespective of their capacity for the task assumed. This has been more especially the case since the introduction of the limited liability principle of proprietary. I know at this time mines conducted by managers totally ignorant of geology, mineralogy, and practical mining, and very indifferent men of business as well.

Permit me to illustrate this, and, indeed, to verify it, so far as that can be done without quoting names and places.

Some six months since a gentleman called at my office conveying the good news of a great discovery having been made in a mine of which he was a director. Knowing the mine and its manager, I told him as courteously as I could that I did not believe in either, although the quasi manager was held up as a model miner. The discovery so-called has vanished, and proved to be a mistake and delusion. Not only that property, but three or four other mines which have fallen under my cognizance, and, directed by the same management, are hopelessly involved in litigation. This is solely attributable to incompetency. Surely, Sir, in any other branch of business a man would be selected to an office of such responsibility only because he was tried and proved. What would be thought of a banking proprietary which would appoint a manager ignorant of accounts, of the principles, and of the routine of banking? What would be thought of an insurance company, or an assurance company, designating a managing director who was no actuary, and had no experience of the risks at which policies are issued, and to which property is exposed? Or who would imagine a body of railway directors committing the superintendence of a line to a person inexperienced in the estimate of plant, the qualities of iron and other material, the routine of wear and tear, and of the reasonable expectations that might be entertained either in the passenger or carrying trade of the districts through which the line passed? In all branches of public direction and economy for which the Government is responsible Parliament insists upon discrimination of fitness on the part of ministerial officials as to the men they nominate to responsible situations, which, if improperly held, involve expense, delay, uncertainty, and disappointment to the public.

Another great and destructive evil is the way in which reports are distorted to suit the interests or projects of the dealer, and thus to feed with opportunity of cajolery illegitimate speculation, and even of positive imposture, the ingenious classes vulgarly called "bulls" and "bears." The maddest of the former in nature, and the fiercest of the latter, are less hurtful than their namesakes of the Stock Exchange. Either of the animals which nickname the classes referred to may destroy life, or wound and injure those exposed to their attacks; but the human "bull" or "bear" may also cause the destruction of life, and as well the devastation of property, the ruin of families, and the dishonour of a profession which they bear purely for the gamester's purpose. Indeed, a gamester is less dishonourable; he runs risks, he may win, but he may lose; but the "bull" and the "bear" in the haunts of civilisation only wins so far as the unfortunate investor is concerned, and only loses to some of his own confraternity, who in the run of things make up for it by losing to him again.

Sir, I appreciate very highly the reports of all practical miners published in the Journal, and am certain they will stand in bold relief in comparison with the advice of mere brokers and agents, totally incapable of forming an opinion as to the merits of the properties they commend or depreciate. The indications of a supposed mining district or property require to be investigated with geological and mineralogical skill, that a judgment may be formed *ab initio* of probabilities.

Nothing but a long experience and practical acquaintance can justify a man in pronouncing an opinion of a piece of mining ground, or upon a lode in a particular mine, which is one of the most difficult points in practical mining. Experience alone can teach a man the probable amount of capital required to drive through or on a vein or lode, the value of either, the character of the indications presented as the work proceeds, the results which may reasonably be hoped for, the character of the ground, the price that may be prudently paid for it and for working it, and the value of a lode, or the tribute at which it should be set. What Government would send a man not versed in nautical affairs to command the Channel Fleet, or even a single ship; to direct the movement of an army, or of a single regiment or company? Such things, it is true, have been done in the madness, partiality, or nepotism of princes and ministers, but they are referred to with the condemnation of history, and as examples to be deprecated by all free peoples. So the examples set by certain companies, or boards of directors, in placing incompetent and inexperienced men over properties in mines, professedly wrought for the benefit of the investors, deserves to be repudiated and avoided.

It is impossible for you to give space in your well-filled columns to discuss more than a little at a time of the varied subjects involved in the interest to which your Journal is devoted. I shall, therefore, confine myself to this topic in my present letter, hoping that you will continue to afford me space to point out what I think

ought to be done, after a whole life of experience, to redeem and educate mining enterprise, and prove it to be one of the most—perhaps the most—profitable avenue of investments ever discovered, as well as one of the most—and perhaps in this case also the most—useful and beneficent to the working classes and the country at large.

The Bill of Mr. Bruce for regulating the operations in mines shows the old adadge well—"Behold with what little wisdom the world is governed." Fair and free discussion in your Journal will do more than Parliamentary measures. There must be a public opinion created amongst investors, directors, managing directors, mining captains, and mining operatives, whatever legislators may say in the House, or the Legislature may perform. Besides, taking the Bill of the Home Secretary as a sample, the Legislature is not likely to touch the great sources of injury to the whole industry of procuring metals and minerals, but public opinion, and a determination on the part of those who desire to hold mining property to consult competent persons before they invest, and to be assured that the properties with which they are connected are adequately managed, may accomplish much, and certainly will do so if a salutary public opinion can be formed, and that investors will ignore charletans, and consult the intelligent and experienced. THOMAS SPARGO.

Gresham House, Old Broad-street.

ROMAN GRAVELS MINE.

SIR,—Replying to "A Shareholder's" letter on this mine, which appeared in the Supplement to last week's Journal, I would state that mining being in the highest sense a commercial pursuit, no report, however elaborate in other respects, can be complete that does not at least shadow forth the extent of ore ground, the probable monthly returns, as well as the profit and loss account of a mine. With this acknowledgment of the justness of "A Shareholder's" critique on the report in question, I would now give the figures which relate to the debit and credit side of Roman Gravels ledger.

"A Shareholder" will no doubt forgive me if, by way of preface, I tell him that, having been underground to-day, my estimate of the value of the 65 north of cross-cut is 7½ tons of lead ore per fathom, and south of cross-cut (the ends now being about 25 fms. apart) 9½ tons per fathom, with Corfield's winze coming down from the 50, about 45 fms. in advance of the present 65 south, in which winze the lode is 5 ft. wide, and worth 9 tons of lead per fathom, with unmistakeable evidences present of increased width and productiveness as the winze deepens. Those great bunches of ore will enable us to keep up our returns to the quantity estimated for the period limited in our reports, and, when thoroughly opened for stoping by the winzes now well forward for that purpose, must give the increased returns the company has been led to expect. We shall sample 100 tons for the current month. In going into the figures asked for, I shall put the question before your correspondent in a form the correctness of which he may check fortnightly at the company's London office. The returns, owing to severe frost, for January were 80 tons, 40 tons sold at 12*l.* per ton, and the remainder at 11*l.* 19*s.* 6*d.*; value together, 959*l.*, and the working cost, including coal bill and all other accounts for materials had during the month, amounted to 548*l.* 14*s.* 4*d.* The debit and credit account for the six months may, I think, fairly be put down as follows:—100 tons a month at 12*l.*=1200*l.*; six months at 1200*l.*=7200*l.* Monthly cost (say) 600*l.*; six months, 3600*l.*; leaving a balance to credit of 3600*l.* At the end of six months an additional 50 tons will be raised at and out of Corfield's winze alone by three pares of men at an additional cost to the present of 100*l.* a month. I cannot see that the monthly expenditure need exceed 800*l.* when the present runs of ore shall all have been laid open for stoping down to the 80, and the returns increased to 250 tons a month. No mine in Shropshire can be worked more cheaply than this.

Minsterley, Salop, Feb. 15. ARTHUR WATERS.

CARN BREA MINES, AND THEIR MANAGEMENT.

SIR,—Perhaps the "Large Adventurer," and worthy correspondent of the *West Briton* of Jan. 19, may not be aware of present real state of the mine, the management of which he so erroneously condemns, and which he so strongly avers applies to every department. Has he seen the underground department of the Carn Brea Mines, or does he understand mining at all? If so, he certainly must be actuated by some anticipated gain or interest of some kind in the matter; and I pity him very much. If, on the contrary, he is a novice, and understands nothing of mining, and has been influenced by the interested assertions of some unprincipled selfish person, one can excuse him, but for the future I would strongly advise him not to appear in print without getting his information from a reliable source. Fearing he is the dupe of some badly-disposed man, I will employ a little of my leisure to give him a few facts in connection with the state and management of these mines. In the first place, within the last two years there have been expended about 2000*l.* in improving the pitwork, &c., of the old sump-shaft alone, which is almost completed; this will shortly enable them to do away with the working of Barker's pumping-engine, and save about 200*l.* per month to the mine. Then there is the Highburrow east shaft, which is cutting down for an engine-shaft with double skip-roads. This shaft when finished will be one of the best in Cornwall; it has already cost upwards of 4000*l.*, and will shortly be available for hauling from the 165 and 175 fm. levels, where there is an enormous quantity of tinstuff broken, and hundreds of fathoms of rich tin ground opened, which can be taken away at a very cheap rate. In about three months this shaft ought to be ready for drawing from the 213 fm. level, by which time this level should be communicated with the 213, east of the cross-course, where there is already upwards of 60 fathoms in length for 12½ fathoms high of very rich tin ground discovered, worth full 50*l.* per fathom. It is true this ground might have been taken away long since, and dividends paid, but to do so the stuff would have to be drawn to the 200 fm. level by tackle, a mode of working no miner, I apprehend, would sanction; I question if even the "Successful Tin Miner" would,

Now, surely those who live in glass houses ought never to throw stones, and to prove this I ask the correspondent's informant to go into the adjoining mine and examine the curious pitwork and pumping-engines there. I can assure him it would repay him for his trouble, and at the same time greatly amuse him to see the striking contrast, and I doubt not but he would come to the conclusion, with others who have seen them, that they ought long since to have been in the Kensington Museum with the antiquities of olden times, instead of being, as now, in a Cornish mine. The broom should be used at home first, where the cobwebs are more conspicuous. It might have been used with advantage on the western side of a certain valley in preventing the tin from going down to the streamers, where the slime is well known to be four times as rich as that on the eastern side. It is a great pity the owner of this "wonderful broom" did not attend more to his duties at home; far more sensible and honourable would it have been than that of prying into his neighbour's business, and intruding on the rights of others.

Respecting the correspondent's statement of a later date of there being "too many managers," I beg to inform him there was but one manager, and he a gentleman, and as such consulted with those under him. His unwavering, unselfish principles and superior judgment were not to be questioned; he was neither swayed nor biased by any man; knowing the right he would the right pursue. I scarcely need say that gentleman was the late lamented Chairman and director, compared with whom the correspondent, the "Successful Tin Miner," with all his brooms, are as nothing. He was the manager of the Carn Brea Mines, and would not sanction the taking away of the ground underhand in an unminer-like way, as certain people would have liked it done.

Further, if the correspondent is a long as well as "Large Adventurer," he will see the present compares very favourably with the past. Eight or ten years since there was raised only about 3 or 4 tons of tin per month from Highburrow lode, with very little copper; now they are raising about 20 tons of tin, with about 150 tons of copper, per month; at the same time working it at a great disadvantage, by means of a small engine, with 600 or 700 fms. of flat-rods drawing water from four sump-shafts, which, of course, will be done away with when the pumping-engine is erected on Highburrow east shaft. The ground is opening up so well that there will be no difficulty in shortly doubling the returns on this lode. There is also a powerful winding-engine erected, at a cost of about 900*l.*, and a new stamping engine on the mine, and all paid for, yet withal there was a profit shown at the last meeting of nearly 3000*l.*

Now, all this the "Successful Tin Miner" well knew, and only watched his opportunity to slip into a snug nest, to be fed by his own tame birds, and thus use his own dirty broom in sweeping to accomplish a purpose, or becoming still more successful; but success of this kind, or success secured by such means, I do not aspire after.

Sir, there being two sides to this, as well as to all other questions, is the reason for my troubling you with the opposite of that which was given before. Hoping you will grant a small space for this, I have no doubt the discerning public will see to whom the present condition and future prospects of the mine are traceable.

ALSO A SHAREHOLDER.

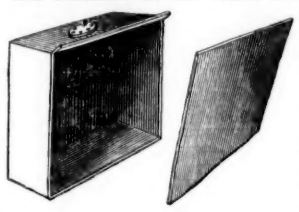
[For remainder of Original Correspondence see to-day's Journal.]

THE SMOKE NUISANCE.—A report has been issued by the committee appointed at a meeting convened by the Mayor of Newcastle, in 1870, to enquire into the practicability of lessening the smoke and other noxious vapours emitted by manufacturers. They state that their attention has been particularly directed to an examination of the different kinds of apparatus attached to steam-boilers having for their object the mitigation or suppression of the evil of smoking chimneys; and, though some were less perfect than others in the results they afforded, all were a decided improvement on the rude mode of firing previously in general practice. The inventions in question may be divided into two sections—those which attempt to vary the quantity of air according to the changing requirements of the furnace, and those by means of which, the supply of fuel being maintained continuously, the air passing through the fire-place is always equal to a perfect combustion of the liberated gases. Of the former, the committee had an opportunity of examining that of Mr. Gall, extensively used by Messrs. H. L. Pattinson and Co., of the Felling Chemical Works. With a furnace, when the smoke under any circumstances was not excessive, this plan is not without merit, but it possesses the defect of all similar contrivances—that, using the small coal of this neighbourhood, thrown on in large quantities at a time, the extrication of gas is so violent immediately after firing, that the ordinary draught of the chimney is unable to draw sufficient air into the furnace to effect combustion, so that, in very smoky fires, all that can be said is that the nuisance is partially diminished. The cost of the apparatus per boiler is about 10*l.* for a single flue, and 11*l.* for a double flue Cornish boiler, including patent right. The other, and by far the best, mode of dealing with the evil is by means of what is termed mechanical firing, in which the quantity of fuel introduced into the fire-place always bears the same relation to the air passing through and over it. This is accomplished by two different forms of apparatus—Vickars' reciprocating and Juckes' revolving bars, the cost of which varies from 80*l.* to 120*l.* per furnace. The committee believe either plan is adequate to the work, but having seen more of Juckes' in use, they can, from their own observation, speak with more confidence of its ready management, and its power of consuming small coal of the commonest description, almost without a vestige of smoke. In saving of fuel and economy of labour, by proper appliances, there is no doubt a fair return will be obtained for the outlay. Messrs. Allhusen and Co., who have evinced a laudable wish to suppress the smoke nuisance as far as possible, have applied 47 of Juckes' bars to their boilers at Gateshead with very satisfactory results. There still remains a large number of furnaces to which, hitherto, neither Juckes' nor Vickars' bars have been considered applicable—glass-houses, potteries, and reverberatory furnaces generally, such as those of puddling, iron heating, and chemical operations of various descriptions. The committee are, however, impressed with the belief that in many cases these classes of manufactures are carried on in a manner in which public comfort and convenience, as regards smoke emission, are left out of sight. In some of these operations Siemens' regenerative furnace has been applied with advantage and economy. With regard to the emission of what are known generally as chemical vapours, it is true the nuisances which belong to this class are to some extent under the supervision of Government inspectors; but it is not the less apparent to anyone who visits Newcastle or Gateshead, when the wind is blowing in certain directions, that chlorine and hydrochloric acid gases are being given off occasionally from the adjacent manufactories. In conclusion, the committee are of opinion that the Acts of Parliament which impose penalties, under certain specified circumstances, on persons using furnaces which produce the nuisance of black smoke, ought to be enforced to the full extent by all magistrates. The committe are also of the opinion that sufficient boiler space and chimney draught should in all cases be provided, and that careful stoking under these circumstances is alone sufficient to prevent the emission of smoke; and they would recommend that the law be emended, so that the stoker, in the event of carelessness, may be subject to punishment. The report is signed by Mr. James Morrison, chairman.—On the same subject a pamphlet containing a series of suggestions for the suppression of the smoke nuisance has been issued by Mr. R. S. Newall, of Gateshead.

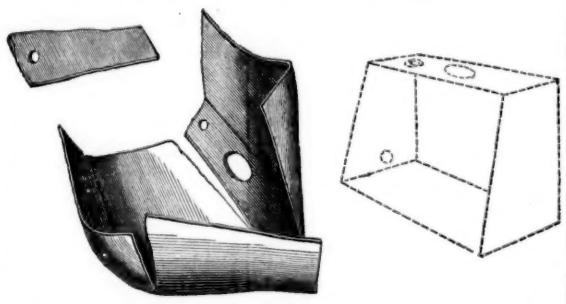
THE EXPLOSIONS OF DOMESTIC BOILERS.

Not a few of the readers of the *Mining Journal* are interested as makers, and many more, perhaps, are concerned as the owners in the character of the steam-boilers used for purely domestic purposes, and that are customarily built into kitchen ranges. Out of the 69 boilers that exploded in 1870, 13 were of this class. Of this 13, 11 were destroyed by the frost having got into the pipes. We perceive from numerous letters that have appeared upon the subject, alike in the scientific weekly and in the general daily press, that very much mental confusion exists upon the question. The prevalent notion is that the boilers explode because of the supply of water having been stopped by the ice in the supply pipe. Such ice having thawed, the water, it is popularly conjectured, flows upon the red-hot plates of the empty boiler, and causes a sudden generation of steam, which leads to the bursting of the vessel. The truth, however, is that the danger is brought about not by the supply-pipe alone becoming stopped by the ice, but by the outlet-pipe also proving from the same cause incapable of acting. Both pipes fast, there at once generates in the boiler steam that it was never intended to hold, and an explosion is the inevitable result. To this double cause the 11 explosions to which we refer were entirely due.

The character of the boilers is shown in three examples with which we are able to illustrate our remarks. These are types of the two forms of wrought-iron and the one form of cast-iron boilers mostly used. The boiler here shown was 2 feet wide, 1 foot 10 inches high, and 7 inches deep. It was made of ⅜-inch plates, with badly welded joints. The explosion blew out the front (as seen), and two people were killed.

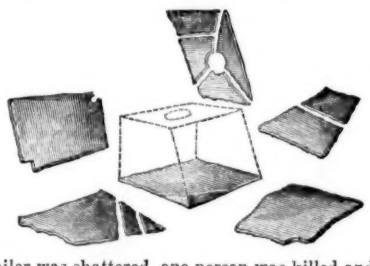


The next cut shows the second wrought-iron boiler. It was 2 ft.



6 in. wide, 2 ft. high, 9 in. across the top, and 13 in. across the bottom. Like the other it, too, was made of ⅜-in. plates. In this case likewise the joints were very badly welded—so badly that directly the pressure came on they gave way, occasioned only little damage to property, but unhappily killed two people and injured a third person. The boiler was used for warming rooms above the place in the house in which it was situated.

The condition, likewise after explosion, of the cast-iron boiler is shown here. It was 1 ft. high, 1 ft. wide, 8 in. across the top, and 12 in. across the bottom. The cast-iron of which it was made was 7-16th of an inch thick. As in relation to each of the other cases, so here the circulating pipes above the cistern had become frozen, and when the fire was re-lighted steam was formed for which there was no escape. The boiler was shattered, one person was killed and two people injured.



The problem is to provide means of safety by a valve or other contrivance, which will act when both pipes are frozen. As a rule, the safety-valves used in such cases—when any at all are used—are apt to stick from want of employment. When the safety-pipe up the chimney is used it is likely to freeze, for in most of the explosions that have happened the houses had been unoccupied some time before the accidents. These usually ensue upon the fires being again lighted. The fire generates steam before the safety-pipe thaws; indeed, if the safety-pipe should act, and a quantity of water be let down the chimney upon a good fire, the cook would be in only a little less dangerous plight than if there had been an explosion. There is much room for the display of ingenuity in the constructing of these domestic boilers. Founders and engineers should turn their attention to the subject. We perceive that no slight authority recommends what he terms the glue-pot boiler. He speaks of a small boiler within a larger. This is the suggestion of Mr. E. B. Marten, the chief engineer of the Midland Boiler Inspection and Assurance Company. It has been objected to the "glue-pot" that you cannot by its use get *boiling* water up stairs. To such objectors it may be replied—"You want too dangerous a luxury for a dwelling-house." Water a few degrees short of boiling the boiler-within-boiler will provide; and with that there are few who would not be content. Our object here, however, is not to advocate this or any other form of boiler. We desire simply to point out the error that possesses the public mind on this question; to show what is the true cause of the disasters to domestic boilers; to illustrate the action of the pent-up steam in such cases; and by these facts together, to set people's wits at work, thereby to secure an effectual remedy. In this matter, as in most others, the adage, we presume, is applicable in which we are taught that a knowledge of the disease is half the cure. We have laid bare the disease, and have told how one physician would cure it; let other doctors give the world the benefit of their preventive skill, and we shall not regret having given a little passing attention to a topic upon which very much has recently been written, and upon which very much more will yet be written, if better means of prevention are not adopted than those now in vogue. This is not a case in which we can fly for relief to a "paternal Government." It is true that the lives of Her Majesty's subjects are taken, but the loudest-spoken applicant for parliamentary interference will hardly demand periodical visits to our kitchen by a gentleman who comes armed with imperial authority to inspect our range. Inventors and makers must see to it.

OCTAGONAL SMELTING FURNACE.

The efforts to smelt larger quantities of ore than was practicable with the ordinary blast furnaces led to the introduction of the Raschette furnace, in which the discharge of the metal and slag takes place at the ends of the furnace, which is long and narrow, so that six or eight tuyeres can be placed at each side. The smelting result of these furnaces is greatly superior to that of the old-fashioned ones with one or two tuyeres, not only with reference to the larger quantity of ore smelted in a given time, but also in saving a greater percentage of metal and fuel. The treatment of such a furnace, however, is delicate, and it required many months running before, by gradual improvement, a long smelting campaign was secured.

It is surprising that the rectangular shape was preferred to a circular one—for instance, one like the old iron-assay furnace of Sefstroem, with blast holes at equal distances on the periphery, the very effective result of which was well known. Mr. Aubel gave an elaborate description of Raschette's furnace, alluding to the same in the circular shape. By theoretical reasoning he tried to prove that a circular form does not admit of a uniform smelting region, and that the consumption of fuel in the centre would be a useless one. Notwithstanding this theory, Mr. Piltz, of Freiberg, Saxony, constructed a circular furnace, 5½ ft. in diameter in the clear, and with eight tuyeres, which has proved very successful, and which it is now proposed to describe.

For the sake of greater convenience in building, an eight-sided shape was chosen. The first furnace of this kind was, says Mr. Guido Kustel, in an interesting communication to the San Francisco *Scientific Press*, built about four years ago at Halsbrucke, near Freiberg. From the start the result was so favourable and so superior to Ratchette's that, with slight modifications in regard to dimensions and number of tuyeres, at this time no other furnaces are in use at Freiberg. Aubel's theory did not prove to be correct. In a properly regulated smelting operation no so-called "pigs" are formed, either in the centre or elsewhere; the slag runs continually, undisturbed by crowbar operations, which usually are frequently necessary in other furnaces, on account of clogging up, &c.

The Piltz furnace is octagonal in plan, and the interior wall is nearly straight, increasing only from 5 ft. diameter at the tuyeres to 6 ft. 6 in. at the feeding-hole. The bottom of the furnace consists of a cast-iron box, in which the brickwork is placed, and the remaining space beaten out with a composition varying with the nature of the ore, being generally composed of one part of clay or loam and one part (volume) of charcoal, coke, or anthracite, all powdered, mixed, and moistened slightly. This composition is beaten in as hard as possible by means of wooden or iron pestles, and either the space is entirely filled, and the crucible or receiver then cut out, or the crucible is shaped during the stamping. The first method is preferable. There are two, sometimes three, tap-holes, leading the mettle into the kettle. The breast rests on a hollow cast-iron pipe, cooled by a constant current of water, as are the tuyeres. The upper part of the wall is suspenced in a cast-iron mantel. The advantage of this arrangement lies in the convenience and facility with which the fire-bricks above the tuyeres, which are mostly exposed to the action of heat and of dissolving substances, can be removed and replaced without interfering with the upper part. Being suspended, there is also free access to the furnace from all sides. In place of the "hanging suspension," other furnaces of the kind are provided with three or more iron pillars, on which the upper masonry rests. The height above the tuyeres differs often greatly up to 20 ft. The section of the furnace widens always towards the feeding-hole, as this has a beneficial effect on the result of smelting. The force of the blast, finding a larger space in the upper region, is diminished as well as the heat, and the ore dust carried out does not amount to more than 1 per cent. The gases, &c., enter dust chambers before escaping through the chimney.

On of these furnaces is attended by one smelter, two slag-wheelers, and three men to feed. Ore and fuel are regularly charged. The metal is tapped, from 18 to 20 times in 24 hours, into one of the two or three tap-kettles alternately. The slag runs continually into a slag-pot of cast-iron, of a pyramidal shape, the base being up. This cone is 29 in. high, and 22 in. in diameter on the top. Matt, or globules of metal, sink through the yet liquid slag to the bottom, in case any should be carried out. When stiff the pot is turned over, the end of the slag cone (where the metal or matt collects) broken off and melted over with the ore. The blast, or quantity of wind, needed is not very great—each nozzle about 125 cubic feet per minute, or for seven tuyeres 875 cubic feet, at a pressure of 1 in. quicksilver.

In 1868 a Piltz furnace, 20 ft. high, smelted in 28 days—

Lead ores	Tons 545·00
Pyritous ores	53·30
Matt and earth from cupellation, &c	220·35
Slag	329·25
Magnetic iron ore	61·00
Limestone	14·00=1219·90

From these were obtained—

Matt	Tons 224·00
Lead	178·26
Silver	1·40
Slag	646·50

The slag contained 1·56 per cent. of lead and 0·71 oz. silver per ton. The above 1219 tons of smelting material (put into the furnace mixed together (consumed 109·8 tons coke (middling quality), or 9 per cent., while the old Freiberg double furnaces consumed 10 per cent., and other furnaces 20 per cent., and over.

ON THE ARCHIMEDIAN SCREW FOR LIFTING WATER.

At the Institution of Civil Engineers meeting, on Tuesday, a paper was read by Mr. WILFRID AIRY, Assoc. Inst. C.E., which was intended to supply information regarding the best form of the Archimedian Screw, and its effect when laid at different angles of inclination to the horizon. After suggesting that the previous neglect of this subject was probably owing to the mathematical and practical difficulties attending the construction of screws in the ordinary way—with the threads at right angles to surface of the core—the author stated that he had adopted another principle of forming the spiral threads, which would simplify the work of construction and produce a more efficient machine. This was to make the spiral threads on the natural and developable system. If an annular piece of card, or tin, be wrapped upon a cylindrical core, having its edge retained in a shallow spiral groove on the surface of the core, it would naturally take up a fixed and determinate position, not at right angles to the surface of the core but inclined to it; and inclined to it at an angle depending only upon the inclination of the spiral groove on the core. The chief advantage of this spiral thread was that it could be made of a single flat piece of plate, and no work was required except to cut out an annulus, which when wrapped upon the core gave at once the spiral surface; whereas the threads at right angles to the surface of the core could only be constructed approximately, by using a great number of small pieces. The developable threads also produced a more efficient machine than the threads of the usual form, as was shown by reference to tabular diagrams.

The first set of experiments was made with models of screws of different spiral angles (the "spiral angle" of a screw being the inclination of a spiral line on the core to the lines parallel to the axis of the core) having only one thread a piece, and the results of these experiments were given on the diagrams; but it was easily seen that every screw ought to have as many threads as ordinary workmanship and convenience would allow. This was also shown by reference to the results of experiment; and it was concluded that to allow of easy fitting, riveting, and examination, the width of the chambers for a large screw should not be less than 18 in. on the square. This condition was used to regulate the number of threads for the models for the second set of experiments.

The second set of experiments was made on six models, whose spiral angles were 20°, 30°, 40°, 50°, 60°, and 74°; the number of threads being varied from four to one. The models were succes-

sively inclined at different angles, and the water contained by each model in its different positions was measured by a measuring glass. These experiments formed the basis of the investigation, and it was deduced from them :—1. That the quicker the spiral, the flatter must the machine be laid to produce its best effect.—2. That screws of quick spiral angle, when laid at their best angle of inclination, delivered a far greater volume of water per revolution than those of slower spiral angle when laid at their best angle of inclination.

In order to ascertain the most economical form of screw, it was necessary to investigate the loss of power due to the internal friction of the water and the external friction on the gudgeons for each machine. This was done by calculation, and the results were obtained numerically for screws of certain specified size, lifting to a height of 10 ft. The frictional drawbacks thus obtained were applied to each machine when laid at its best angle of effect, and the efficiencies of the different screws were then calculated. The result showed that the machine whose spiral angle was 30° was the most economical, but that the machine whose spiral angle was 40° approached it very closely. The best angles of inclination for these two machines were respectively 25° and 30° to the horizontal. In the most favourable case, the useful effect of the screw appeared at 88 per cent., and it was concluded that, after making allowance for certain small losses referred to, the useful effect of a well-constructed screw should not be less than 85 per cent.

Reference was then made, by way of comparison, to other machines commonly used for low lifts—suction-pumps, centrifugal pumps, open Archimedean screws, scoop-wheels, chain-pumps, and Persian wheels, and the paper concluded by pointing out the various advantages of the Archimedean screw, more particularly as regards its durability, simplicity, and useful effect.

The communication was illustrated by the series of models from which the results were obtained, and also by a screw, 5 ft. in length, constructed on the system of threads advocated by the author. A model was likewise exhibited to show the improvements which might be applied to obviate the defects of scoop-wheels, as at present constructed and mounted.

COMPRESSED AIR AS MOTIVE-POWER.

We have become so accustomed to the use of steam as a motive-power, that we are disinclined to give any other fluid even the credit which practical application proves it to deserve, and hence it is that any machine which it is proposed to work with either compressed air or water can scarcely obtain a fair trial. It is to this cause that we must attribute the disinclination to adopt certain of the coal-cutting and drilling machines that were at first exhibited. But, happily, those connected with the Burleigh rock drill, and the driving of the Hoosac tunnel, have so thoroughly succeeded in overcoming every obstacle that complete confidence in compressed air as a motive-power has been established. An important paper on the subject has recently been read before the American Institute, by Mr. J. F. Haskins, whose experience in the manufacture of the air-compressors used in the Hoosac tunnel enables him to speak with authority, in which a large amount of new and valuable information is given. The student, he remarked, in searching for information on the subject is met at once by that stern law as to the resistance of the flow of air in pipes—"the resistance increases as the square of the velocity, and is further augmented by the square of the quantity." This, he continued, is both true and false. True as it was determined by those who recorded the law, and false as air is to-day conveyed and handled. The present practice has carried at Mount Cenis air at 50, 60, and 70 lbs. to the square inch four miles, in pipes of 8 and 10 inches in diameter; and under his own eye, at the Hoosac tunnel, Colorado, they are daily carrying air at 60 and 65 lbs. one and three-quarter mile, with little or no loss. Nor are either of the above the first or only instances of long conducts; they are numerous, and in pipes of 1 inch to 10 inches in diameter. In the business in which he is and has been engaged for some years, that of designing, building, and operating air-compressors and rock drills, they are frequently called upon to carry air at high-pressure long distances, and they daily meet with instances where it would be impossible to do so if the law, as stated, were true. This is one of the numerous instances wherein practice always proves to be of value.

The subject was first studied by Mr. Haskins some twelve years since, when as foreman of an establishment in Massachusetts he entered upon the manufacture of Ericsson's caloric engines, air-compressing pumps, and machinery to be run by them, so that it was to John Ericsson that he was indebted for his first knowledge of the subject, and first opportunity to gain further information. Just now they found parties almost daily enquiring if they could convey air various distances, and run machinery with it. Most certainly they could, and that, too, economically. There are numerous instances on record where it was done long years ago, and to-day he could point to very many cases where it is being done daily, and creates no wonderment. Many years ago Capt. Ericsson was applied to by a New York clothing firm for relief in the way of power to run sewing machines. The relief was readily furnished, and a caloric engine in the cellar compressed the air; it was carried to the upper stories in pipes, and there moved little engines, which in turn operated sewing-machines to the number of some eighty. And this is not all, the act of compressing air throws off its heat, and then when it is again exhausted, it of course takes up that heat again from the surrounding atmosphere, doing two things, condensing and precipitating, the vitiated air, and furnishing one of the best possible means of ventilation. These machines worked successfully for years, and were only stopped when business lagged. In 1853 or 1854, at Glasgow, there was built from the designs of Mr. David Elder, an air-compressing engine, known as Randolph's air-pressure engine. This engine compressed air to 20° and 30°; it was then conveyed down to the lower level of the mine, and there actuated an engine similar to a steam-engine to do the needed pumping. It ran for years successfully and economically, and yet the world has never known it. It is being done to-day in various places using ordinary means, but as the world moves this plan is now to be superseded by a much simpler plan, compressed air still being the motor, but without the intervention of an engine.

Now, were the law already referred to always literally true he feared some of these things might not be accomplished. Within a year there has been a great deal said and written as to the *possibility* of running horse cars by means of compressed air. Anyone might have learned upon enquiry that such a thing was not only possible, but that it had been done on a small scale a dozen years ago; he, with a friend, had filed a caveat for doing so in 1858 at the Patent Office, after a series of successful experiments, extending over some months, and to-day cars are running so driven, and there is not the slightest reason why they should not. Compressed air, then, is a reality, and the plans for using it are many, yet few are really of utility, or are commercial successes. They may be named as within three classes—the water column, the piston immersed in water, and the piston simply packed and lubricated by water, or other fluids. Of the first-class there are several varieties, all, as far as his knowledge extends, have in them elements of success. They operate upon the general plan of starting and stopping a column of water. Other apparatus depending on a column of water for its power has been constructed, and there are several parties now experimenting in that direction. It is a grand field—open to, and inviting the attention of the mechanical world, and few fields offer greater inducements. Of the immersed class of compressors, there are also several. They do well for low pressures, but not as well for high ones, the difficulty being that the piston in moving has also to move a large body of water, which, of course, absorbs an amount of power equal to its own inertia—the names of Ericsson, Sommellier, Doane, Butler, Burleigh, Spear, and Haskins appear as inventors of the last class, and among them they have indeed produced some queer machines, and surmounted what in years past were considered almost insurmountable obstacles.

In Mr. Haskin's judgment there is not the slightest difficulty in transmission. He regards the proposition of Mr. Day, to harness the lower Genessee falls and convey its power to Rochester, as more than feasible. Once success is demonstrated there, how many other similar spots can be found to apply the apparatus to? Think, he says, of the immense number of uses to which the compressed air could be put when it could be had by turning a stop-cock in each house, as is now the case with gas! Mr. Robert Spear, of Portland, Maine, has invented numerous devices in connection with compressed air, among them a pump for use in many places, as mines, deep shafts, houses, and other places where steam will not answer. It has much merit. He has also a system of pipe for transmitting air, which is a departure from all settled plans, and yet promises success. So almost daily the army of inventors are aiding the great cause, each by his little addition to the general whole, and the progressive party should aid the onward march to more air, and that compressed. We have already stated that where the Burleigh drill is at work in this country it has given complete satisfaction, and it is understood that but for some unavoidable delay on the part of the manufacturers many more would by this time be in active operation. The improved arrangements made for compressing air, to which Mr. Haskins alludes, seem calculated to remove the last obstacle to the successful working of the drill, so that it may be anticipated that before long the Burleigh drill will be recognised as an indispensable article of a mining plant, just as Blake's stone-breaker is at present.

MINING ASSOCIATION OF GREAT BRITAIN.

The seventeenth annual meeting of the Mining Association of Great Britain was held at the Craven Hotel, Strand, on Wednesday, Mr. JOHN STRAKER, President of the Association, in the chair. The following gentlemen were present :—Messrs. George Elliot, M.P.; James McMurtrie, Radstock; G. Gilroy, Wigan; G. C. Greenwell, Poynton; George J. Baker, Wolverhampton; Thomas Knowles, Wigan; A. Hewlett, Wigan; John Knowles, Manchester; John Daglish, Tynemouth; Thomas Udall, Silverdale; Fereday Smith, Manchester; W. T. Lewis, Aberdare; W. A. Potter, Cramlington; Charles Binns, Clay Cross; William Bean, Alfreton; J. B. Pope, Leeds; — Mathews; Robert Harrison, Eastwood; J. P. Hunt, Corngreaves; T. W. Plusey, Old Park Ironworks; A. M. Chambers, Sheffield; H. Mitford, South Staffordshire; Robert Heath, Newcastle, Staffordshire; G. Thompson, Ruabon; E. Fisher Smith, Dudley; T. E. Horton, Shropshire; John T. Woodhouse, Derby, treasurer; and Maskell William Peace, Wigan, solicitor and secretary.

The SECRETARY having read the report of the Executive Council, its adoption was moved by the PRESIDENT, seconded by Mr. UDALL, and carried unanimously.

The meeting then proceeded to the appointment of officers for the current year. On the motion of Mr. HEWLETT, seconded by Mr. ELLIOT, and supported by Mr. FEREDAY SMITH, it was unanimously resolved :—"That John Straker, Esq., be president of the association for the current year."

Mr. STRAKER having acknowledged the compliment paid to him by his re-election, the following gentlemen were appointed the executive council for the ensuing year :—*From the districts of Northumberland and Durham:* Messrs. T. E. Forster, Henderson, Morton, Daglish, C. L. Wood, Straker, Lindsay Wood, and Potter.—*From Cumberland:* Mr. Isaac Fletcher.—*From Yorkshire:* Messrs. Evans, Haigh, J. B. Pope, and Stewart.—*From Derbyshire, Nottinghamshire, and Leicestershire:* Messrs. Binns, Woodhouse, Bean, and Harrison.—*From Lancashire and Cheshire:* Messrs. Gilroy, Hewlett, Fereday Smith, J. Knowles, and Greenwell.—*From South Staffordshire and Worcestershire;* Messrs. Mathews, Williams, Hartley, Baker, and J. S. Hunt (Chairman of the South Staffordshire Iron Trade Association). - *From North Staffordshire:* Messrs. Heath and Udall.—*From Shropshire:* Mr. Horton.—*From Gloucestershire and Somersetshire:* Mr. McMurtrie.—*From North Wales:* Mr. Geo. Thompson.—*From Warwickshire:* Mr. Darlington.—*From Dean Forest:* Mr. A. Goold.—*From South Wales:* Messrs. Elliot, Clark, and Nixon.

A resolution was then passed empowering the Council to add to their number.

On the motion of the PRESIDENT, seconded by Mr. MATHEWS, the cordial thanks of the meeting were unanimously tendered to Mr. Woodhouse for the valuable honorary services which he had for many years most efficiently rendered to the association as its treasurer, and requesting him to continue those services during the current year.

Financial arrangements having been made, and a meeting of the council fixed to consider in detail the Mines' Regulation Bill and the Trades' Union Bill now before Parliament, the proceedings were brought to a close with a unanimous vote of thanks to the Chairman.—*Colliery Guardian.*

MINES REGULATION AND INSPECTION.

In the House of Commons, on Monday, Mr. BRUCE, on rising to ask for leave to introduce a Bill to consolidate and amend the Acts relating to the regulation of mines, wished to call the attention of the House to the points of difference between it and the measure introduced last session. After the Bill was brought into this House last session, a noble lord, who had long presided over the Royal Commission appointed to enquire into the state of metalliferous mines, which were not dealt with in the Government measure, introduced a Bill relating to those mines and giving effect to the recommendations of the Commissioners. Thereupon he undertook on the part of the Government to introduce as amendments in the Bill substantially all the provisions of the measure respecting metalliferous mines. The present Bill would, therefore, deal not only with coal mines and iron mines in connection with coal mines, but would have reference to all the mines in the country. To the suggestions made by several hon. members he had given the most careful consideration, and the result was that in one or two not unimportant respects he had found it necessary to modify the Bill. The Committee, which sat for two years investigating this subject, recommended a modification of the most important of all the general rules respecting the regulation of mines. The present rule was that all coal mines and iron mines in connection with coal mines should have an amount of ventilation sufficient under ordinary circumstances to dilute the noxious gases. Some inspectors found it difficult, however, to obtain convictions, as the magistrates frequently said there was no proof that the circumstances were ordinary. Consequently it was proposed to lay the *onus probandi* on the owners of mines and their agents, instead of on the other side. He had consulted the Inspectors of coal mines, and the result was the conclusion that, on the whole, it was best to retain the law in its present form. The Select Committee felt the greatest difficulty in dealing with the education of miners, but they were agreed that the present regulations were altogether imperfect, and that the provisions made with the object of securing the education of miners were illusory. The Act provided that a child who could pass an examination in reading and writing might be employed in a mine; but it took no security for the character of the examination, such as providing that it should be conducted by a certificated master; and the consequence was that in many cases a most imperfect knowledge of reading and writing was certified as being sufficient. As soon as the examination was passed a youth was employed without restriction, and that under circumstances must adverse to any kind of culture. Could anything be conceived more miserable than the condition of a boy of tender age shut up for 12 hours at a time in a dark atmosphere, and altogether cut off from many opportunities of acquiring intelligence possessed by boys who spent their time above ground, even although they were not at school? The Select Committee considered this matter fully, and especially when it would be possible to introduce the half-time system, and they arrived at the conclusion that it was best to exclude children from mines until they were 12 years of age, trusting that up to that age they would take advantage of the educational facilities now to be extended to them by the Act of last year, and believing that, if this exclusion were carried out, it would be unnecessary to impose any further restriction. The Factory Acts and the Workshops Regulation Act provided that children under thirteen years of age, who were at work, should be secured a certain immunity from extreme labour, and a certain amount of education; but as, in the case of miners, it was proposed to relieve children from work up to the age of 12, it was considered less necessary to put them under the Factory Act for the remaining year, which, indeed, would create a great amount of inconvenience, and would not be productive of much good. He stated last year that of all the suggestions that were made the most practical seemed to be one offered by the hon. member for Halifax, supplemented by the hon. member for Brighton, which was that children should be allowed to enter the mines at ten, and to work three days a week, and that they should attend school at least ten hours a week. He had received from the Association of Miners a proposition of a new and startling nature, which was that no child should enter a mine under the age of 12, then only on passing a certain examination; that from 12 to 16 the labour should be limited to eight hours a week; and that a youth should attend school a certain number of hours a week. He did not doubt the perfect sincerity with which the Association endeavoured to promote the education of the children of their own class; but he was bound to say there was something more than a desire for education in this proposition. It was an object with many Trades Unions to prevent the employment of children in order to keep up the rate of wages; and when such a proposition as this was made we must see in it some object other than the advance of education. He saw no reason why the age at which children began to work in collieries should be greater than the age at which they began to work out of them; and Parliament had an opportunity of considering the subject when the Workshops Regulation Act was passed. He thought it was just and fair to adopt as far as possible the lines that had been already laid down, and he, therefore, proposed to allow children to be employed at the age of ten, to limit their employment to three days a week, to require that they shall attend school ten hours a week, and to maintain these restrictions up to the age of 13. With respect to the hours of labour, the propositions of the Bill were substantially the same as those of the Bill of last year, and it was then proposed to limit the labour of all boys under 16 to 56 hours a week, and at the same time to provide that under no circumstances should a boy be kept down a pit more than 12 hours a day, including an hour and a half for meals and rest. The work in mines was not, generally speaking, of a tiring nature, and he believed that the work done by a child in a factory was, on the whole, more tiring than the work done by a child in a colliery, which was often confined to the watching of doors and opening and closing them as required. Another proposed change would be received with satisfaction. It was put forward as an injustice last year that miners should be liable to imprisonment, without the option of a fine, for certain offences, and that agents and others, often as culpable, should be punished only by the imposition of fines. There was a distinction between the two cases, for the offence of the workman was often clear and definite, while that of the agent was more indirect and complicated, and less easy to prove. He was still of opinion that a workman should be subject to imprisonment if his conduct deserved it; but he proposed that there should be a right of appeal whenever a man was sentenced to imprisonment without the alternative of paying a fine. These were the alterations of importance that had been made in the Bill; and there were others which would be more conveniently dealt with in Committee. He had been enabled to meet the wish of the hon. member for the University of Edinburgh that some provision should be made for the examination of agents. He had given the subject a good deal of consideration, and he had arrived at the conclusion that it was far more dangerous than advantageous for the Government to interfere in the matter by attempting to influence the choice of agents. The defects that existed in the management of collieries did not arise so much from a want of education on the part of the managers as from a want of attention to duties, and from failure to use the means at their disposal for securing the safety of those intrusted to their charge; and these were failures against which no examination could provide.

Leave was given to bring in the Bill.

THE EBBW VALE IRON COMPANY, AND THE TRUCK SYSTEM.—At the meeting of the Truck Commission, at the Law Institution, Chancery-lane, on Tuesday, Mr. EDWIN GROVE, secretary of the company, said he wished to call attention to two points mentioned by Mr. Dale. One was where he inferred that Welsh ironmasters, who had complete stores, saved 10 per cent. on the amount of their labour. As far as their experience went, from 1869 to March, 1870, their total profits on the stores came to less than 3 per cent. on the wages. The total amount of wages which were paid in that time from the four firms to which he referred was 398,321*l.*, and the profits in that term were 10,915*l.* These profits mainly arose from the fact that they paid cash for the goods they bought; they did not get goods, as a rule, on credit. In the particular year to which they were referring, he found that they only gave acceptances for 2056*l.* With regard to Mr. Patterson's evidence, he had to state that the remarks he made, and the figures he quoted, were not prepared for the Commission, but were the ordinary accounts, drawn up and issued to the shareholders. He considered that their average profits all through on the stores at their four works did not amount to more than 7 or 7½ per cent. On their purchases the profit would not be more than 8 per cent. Their balance-sheet was audited by Messrs. Cooper Brothers, including those referred to by Mr. Patterson.—By Mr. BOWEN: The auditor would consider it his duty to test the figures presented to him? He would consider it his business to say whether any particular set of figures was entered wrongly or not. There were managers set apart to look after the shops. The figures showing the profit on the shops at 10,915*l.* he took himself from the balance book. That was the ordinary way in which he obtained such items; they were not specially taken out for the purpose of the Commission. His figures were obtained from books under his control, and not from a previous statement submitted to the Commission. They had not debited themselves with any interest on the capital employed in the shops. He could not explain how it was that the shop was represented as having paid 5281*l.* more than they had received from the office. The figures were 37,900*l.* as received from the office, and advanced to the workmen by the shop 43,220*l.* Upon consideration he believed that the misunderstanding arose on the slaughterhouse account, which supplied 4175*l.* worth of meat during the half-year to the shop, and that had not been added in a proper way. The slaughterhouse account was connected with their farm, and the item he quoted was the actual value of the meat supplied. They paid a large proportion of the 4175*l.* away, through their farm manager. They did not get value to that amount from their own farm; but, deducting that sum, he saw there was a deficiency of 1200*l.*, which he could not explain. The total amount of their profit (10,915*l.*) was made up in the ordinary way; he could not submit any sheet explaining how it was arrived at. Their company was a joint-stock concern, the registered capital was 2,400,000*l.*, and they had been in existence six years. In the year ending March, 1870, they paid a dividend of 5½ per cent. Their paid-up capital amounted to 2,050,380*l.* He had had 20 years' experience in Welsh ironworks, and he considered the store principle worked well. The private shops could not sell at the same price as they did, and there was no compulsion on the part of their workmen. Their manager was always anxious to reduce, as far as possible, the price of the goods to their workmen, and frequently consulted with their shop manager with that view.

SULPHURIC ACID.—Iron pyrites is now imported in enormous quantities from Spain and Norway for the manufacture of sulphuric acid on Tyneside and in Lancashire. After the extraction of the sulphur from the Spanish ores, the residue is operated on for the 2 per cent. of copper it contains; and in 1869 no less than about 4000 tons of metal were thus obtained; the entire yield from native ores in the same year being 8291 tons. The importation of those pyritic ores increase rapidly; and it is not unlikely that Newcastle and Liverpool may by-and-bye take a large share of what has hitherto been a speciality of Swansea.

REFINING CAST-IRON.—From America we are promised a new process for refining cast-iron, by which an enormous saving is to be effected, and the operation simplified. Fluor-spar—well known as Derbyshire spar—and peroxide of iron—such as the Cumberland hematite—in powder, are mixed and spread over the bottom of the pig-moulds into which the iron from the blast furnace is run. The heat of the iron causes flourine and oxygen to be liberated; and by reason of their affinities for silicon and phosphorus these impurities are vapourised. "The resulting metal with respect to silicon and phosphorus is as pure as wrought-iron." This process, patented by James Henderson, will soon be brought to the test of practical utility in this country. Considerable attention is also directed to the "Sherman process," which is said to be in successful operation at Pittsburg, Pennsylvania. In this process iodine appears to take the place of fluorine. These elements are of such an analogous character that probably our patent lawyers would call the one "a colourable substitution" for the other.

CHLORINE.—Dr. Odling delivered a lecture, at the Royal Institution, on "Recent Improvements in the Manufacture of Chlorine." We allude to this only for the purpose of directing attention to the remarkable process by which chlorine is now being obtained in enormous quantities for the use of the bleacher or the chemical manufacturer. It will be well known that chlorine is ordinarily obtained by decomposing muriatic acid by the action of the peroxide of manganese. By the new process, a mixture of muriatic acid and air is passed, at an elevated temperature, over a mass of bricks which have been saturated with sulphate of copper. The result is that the oxygen of the air seizes the hydrogen of the acid to form water, and the chlorine is liberated in a constant stream. The remarkable feature in this operation is the physical influence of the copper-saturated bricks. The arrangement once adjusted does not appear to require any restoration, and the decomposing power acts uninterruptedly. Muriatic acid vapour and common air, in mixture, are driven in, and chlorine and water flow out.—*Athenæum.*

STEEL.—Mr. C. L. FRANKS, Finsbury, takes cast-iron, and melts it in a puddling or similar furnace, together with 7 or 8 per cent. or thereabouts of hammer slag, or, what is better, he prepares the bottom of the furnace in the usual way with iron oxide and slag. He then adds 1 or 2 per cent. or thereabouts of a chemical mixture. The metal is well rabbled, so as to thoroughly mix it with the chemicals. When it boils, as it will do under this treatment, a further quantity of the chemical mixture is added, say about 1 per cent. Afterwards the metal is balled up, and it may then be hammered or squeezed and rolled into bars in the usual way.

COMPRESSING GUNPOWDER.—By the invention of Mr. J. JAMES, Princes-street, between the head of a hydraulic press and the table of the ram there are arranged three strong plates or slabs. The upper slab is fitted with numerous punches projecting downwards, and made to slide laterally in grooves, its sliding movement being effected by means of a screw worked by hand, as in a slide rest. The middle slab is perforated by numerous holes, one hole corresponding to each of the punches in the upper slab, these holes forming the moulds or dies for the pellets. The slab is fitted in the framing of the press, so that it cannot move laterally, but can move a little upwards or downwards. When it is in the lowest position it can be prevented from moving upwards by stops inserted above it into grooves in the framing of the press; it can likewise be kept separate from the lowest slab by stops inserted below it and between it and the lowest slab.

MANUFACTURING GAS.—The invention of Mr. W. WILSON, Manchester, consists in the use and application to retorts used for the manufacture of gas from coal oils of a pipe leading direct from the retort to the hydraulic or tar condensers, the top of such pipe being provided with a water joint or lute to allow of such pipe being cleaned out without breaking any joint as hitherto practised. The cistern to contain the coal oils, and the pipe leading therefrom to the retort, are surrounded by an outer casing, through which warm water is caused to circulate, supplied by a cistern, which also supplies the water joint.

CHLORINATING ORES.—The invention of Mr. C. STETEFELDT, of Austin, U.S.A., consists in dropping a mixture of pulverised ore and salt through a vertical, or nearly vertical, shaft through which the products of combustion are ascending, whereby an almost instantaneous chlorination of the ore is effected, which leaves silver ores ready for amalgamation or lixiviation, prepares copper ores for lixiviation, and sets the gold in gold sulphurets free for amalgamation.

TREATING ORES.—Mr. J. BERNARD, Salisbury-street, proposes to pass the fumes or products to be condensed through filters, either in a dry or wet state or submerged in water. He forms a chamber or enclosed space in communication with the furnace and flues to be employed, in which he places and arranges one or more "screens" or "frames," of any desired shape, so that when the fumes to be condensed are forced or drawn through the chamber condenser by any convenient exhausting or forcing machine, the vapour to be condensed is made to pass through the material forming the frame or screen, which will have the effect of depositing the vapour thereon.

CAST-IRON.—The apparatus Mr. A. B. BERARD, Paris, proposes to employ for reducing the ore consists of a gas generator and of a reverberatory furnace, provided with a half-eye furnace on its upper part. The gas generator is somewhat similar to that described in the specification of letters patent bearing date December 7, 1868 (No. 3715), except that the inventor applies to the latter an apparatus for regenerating and purifying the gas produced in the gas generator, properly so called. After passing through a re-heating tubular apparatus, gases are introduced into a hollow place of cylindrical or prismatical form, containing coke mixed with powered lime to promote the fusion of the cinders, and burnt by means of a blast; he also introduces water-steam thereto. The gases pass through this coke, and water-steam and the tarry matters are decomposed. The combustible gases on leaving this apparatus are utilised for the reduction of the ores or other heating purposes. The reducing apparatus consists of a reverberatory furnace, provided with a small vertical or inclined cupola furnace on

its upper part. The reverberatory furnace has a movable sole plate, and serves as a crucible for receiving the cast-iron as soon as it is produced in the cupola. The blast furnace is charged with ore, fuel, and fluxes in the usual way. The reducing gases from the gas generator pass and are burnt over the crucible, then through the cupola containing ore.

SILVER PROCESSES IN THE PACIFIC STATES.

Although the merits of the Stetefeldt Furnace are fully recognised in the Pacific States, it seems that it is not without rivals, the Bruckner cylinder being apparently that which, for the moment, attracts the largest amount of attention. It is stated that in Nevada a Stetefeldt furnace of the capacity to smelt 30 tons per day costs 2000*l.* to erect, and that an equal amount of work could be done with six Bruckner's cylinders, costing not more than 1450*l.*, showing a saving in first cost of 560*l.* in favour of the cylinders. In the item of labour advantage is also claimed for the cylinders. For a 30-ton Stetefeldt furnace it requires two men to feed, two to fire, and three to draw and cool the roasted ore; and the advocates of the Bruckner system claim that with six cylinders working it will not take more than one man to three cylinders, or four men in 24 hours, and, even allowing one man to every two cylinders, it would still leave a gain of two men as compared with the furnace. With regard to fuel it is admitted that the advantage is in favour of the Stetefeldt furnace, which consumes a cord of wood for every 7½ tons of ore treated, whilst the Bruckner cylinders consume a cord of wood for every 6¾ tons treated; but this, it is said, amounts to only half a cord in 24 hours, being equal to a saving of less than 10 per cent. The quantity of salt used is assumed to be the same in each process. It is claimed for the Stetefeldt furnace that by its use silver should never be chloridised below 90 per cent., but the Bruckner cylinder is said to be full equal to the furnace in the chloridising capacity, and capable of doing fully as good work. At all events, the mills in Austin, Nevada, return to customers but 80 per cent. of the assay value of their ores, and we doubt if any of the mills using the Stetefeldt furnace does any better. The general public can, of course, never expect to know the exact percentage of bullion obtained from their ores, and while we may all suspect that the Stetefeldt furnace or the Bruckner cylinder gets more than 80 per cent., or even know such to be the case, our only guide as to the relative value of two machines as chlorodisers must lie in a test run of each, both using the same ore.

The prominent points wherein the Bruckner cylinder is claimed to be superior to the Stetefeldt furnace are—firstly, the readiness with which a mill using the cylinders can be moved from one locality to another, which is totally out of the question in case of the furnace, which, when once built, must stay in the one spot, as it would be cheaper to build an entirely new furnace than to attempt to tear an old one down to rebuild elsewhere; secondly, in the greater economy in fuel by the use of the cylinder in a district where the ore supply is variable, and not constant. If, for instance, the supply of ore sent to a Stetefeldt furnace should from any cause—and such things as snow storms, accidents to teams, &c., are common in all mining countries—be decreased by one-half, the same number of men to run the furnaces must be kept employed, and the same amount of fuel used, as if the furnace were running to its full capacity; whereas, if the cylinders were used, but one-half of them need be run, and the same saving could be made in the items of fuel and labour. And, thirdly, the royalty charged by the patentees of the cylinder is much lower than that charged for the use of the furnace.

Notwithstanding the claims, however, put forward for the Bruckner cylinder, it is considered more than improbable that the cylinder will ever be used as a substitute for the furnace, although when a party has but 500*l.* at disposal they might be induced to erect a couple of cylinders, rather than have no chlorodising contrivance at all. Every cylinder requires one-horse power, at least, to run it, and this must be taken into account in comparing the two processes; and another point, about which nothing is said, perhaps because the result would be unfavourable to the cylinder, is the relative durability of the two contrivances. The Stetefeldt is a really substantial furnace, occupying an important position amongst the plant of a mill, whilst the cylinder has all the advantages of portability and defects of weakness possessed by the furnaces usually carried by travelling tinkers. If for apparatus which will prove equally durable and perform an equal amount of work, the first cost of the furnace is 2000*l.* against 1450*l.* for the cylinder, the latter should, of course, be adopted; but if, as is alleged, two sets of cylinders would be worn out as quickly as one furnace, it is better to trust to the furnace.

THE COPPER TRADE—SOUTH AMERICA.

The west coast of South America is the great copper-producing country, and will be greater, because it also has fields of coal (in the Straits of Magellan and in Southern Chili). The whole range of the Andes contains mineral wealth. Along the coast of Chili, Bolivia, and Peru may be seen the indications of copper with the naked eye in many places, as well as numerous smelting-works on the shore. The copper mines and deposits were known to, and worked by, the aboriginals. Peons, in many cases, learned their location, and sold them for a few reals to gamble with, and then, perhaps, went to work in them at 12 cents a day. These mines are immense in extent and richness, but the difficult nature of the country—precipitous cliffs rising from the sandy desert along the shore, lack of water and food, and the inertness of the working class, prevented their being worked, except in a superficial manner, up to within a comparatively recent period. Some enterprising native, however, as well as a number of English and a few American business men, saw that legitimate mining operations must bring fortunes, where the mere surface mining of the natives could produce the large quantities bought from them at prices so exceedingly profitable to themselves, and yet so very satisfactory to the miners, and they went to work in good earnest to realise these fortunes. They built wagon and mule roads at heavy expense, procured European and North American engineers, and were not afraid to tunnel through mountain and rock so as to reach the rich veins at the most practical points for permanently economical mining. Steam-engines were brought from England, smelting-works were multiplied, and railroads were built connecting the mountain ridges with the sea-ports, the mines with the smelting-works; and it seems that the American engineers were as little frightened at the grades and curves and overhanging rocks they had to pass as the sure-footed mules. These railroads up to the mountains are splendid triumphs of engineering skill, and in view of the arid, desolate country in which they had to be built, show that energy and endurance can be infused into the natives by North American example. Native copper in pieces and sand (barilla) is largely produced both in Chili and Bolivia, and a number of new railroads are projected, by means of which transportation can be so facilitated as to decrease the cost of this copper, and meet the decline in its value by the increase in product. All the other ores of copper occur in these countries, and generally in veins of gigantic proportions, while the decomposed varieties, carbonates, are abundant in many points on the surface. Nowhere else do the sulphurets of 50 and 70 per cent., pyrities of 25 per cent., occur on such a scale of magnitude as on this west coast. From Valparaiso north we find many copper harbors or beaches—Tongoy Bay, Coquimbo, Coplapo, Caldera, Chaneral, Cobija, Tacna, Iquique, with Tarapaca in its rear; between them lies the desert of Atacama. But the most famous mines are those of Tamaya, for which Tongoy and Coquimbo are the shipping ports. They are situated near the summit of a mountain beyond the Limari valley over 4000 feet high. This mountain is intersected by a vein or lode running north and south, cropping out on the eastern side of the mountain about 500 feet below the summit, and dipping to the west at an angle of 52 degrees, being from 7 to 21 feet thick, and filled with ore varying from 25 to 50 per cent. in richness.

A number of mining companies or individuals have worked here, sinking shafts and driving galleries, and bringing out the wealth of ore, only the rich portions of which were shipped, while the poorer ones were left to accumulate near the mines, to prove a source of good income on the establishment of better lines of communication than mule paths, and a sore item to copper speculators. Here it has paid to run tunnels into the mountain 1200 feet long, and to sink shafts 1000 feet deep, and to work out miles of galleries, as well as to set up hoisting apparatus of the most modern description. For pumps there is not so much occasion; the miners would rather they could get more water out of the mines for ore-dressing purposes. One proprietor, whose claim seemed situated in an impractical point, went to work back of the other miners, sunk a shaft perpendicularly, which exhausted ten years of labour and almost his whole fortune, but struck the vein, as he was bound to do, since it dips at a regular inclination, and then had the best of the other miners, who were thus cut off. Several new tunnels are driving in, one of them from the south, along the vein and below the upper workings, to be a mile and a half long, through which the ore can be run out in carts and, finally, on railroad trucks to the smelting works, or to the seaport for shipment.

Ten thousand people live here above the clouds, engaged in mining. Women and boys pick over the ores coming out of the mine, which are, in some cases, crushed and washed, the refuse being still preserved as available in the future, but with the establishment of furnaces most of the ores are now carried to the nearest smelting-works. The railroads have changed the whole economy of the copper production of Chili, for not only do they bring the ore from the mines, but they can transport coal, as well as food, to the mines. As the rate of wages in those countries is "elastic"—that is, the labourer need only fall back upon the three or four days out of the week that he chooses to spend in pleasure, when his wages are lowered—the question of transportation was the only one of paramount influence on the production, the mining itself being incomparably fruitful. Now, the cost of transportation, not only on the coast, but, in some cases, from near the mines, being reduced by railroad trains as against mule trains, and the bulk to be carried absolutely by three-fourths where ores are smelted, it follows that the margin for a decline in the price of the copper obtained must have been immense, when compared with the situation of the business as it formerly existed. As with other mining regions, aggregate results as well as individual cases have to be considered. Some miners may have been stopped from working by low prices; others like Mr. Urmeuita, could afford to undersell the rest by 50 per cent., but, on the whole, the steadily increasing annual production, in the face of continually lowering prices, proves that the business is satisfactory at the present time, and that the ratio of future production will keep up with the steady march of improvements that are being pushed forward in this rising country, and that the cost of producing must continually diminish in a region like this, were the miner can choose the rich lodes, and can afford to leave the poor ones alone, where the poorer ores can be had for the trouble of picking over the mountain sides without any mining, it being understood that what are called poor ores there would be almost considered rich in other parts of the world. As already stated, the production of the west coast has more than doubled in fourteen years in quantity, and, no doubt, in value, as far as the profits of the parties engaged in the copper business there are concerned; and the development is still going on vigorously.

MINING IN INDIA—THE PUNJAB.

Most of our readers have heard of the salt mines to the north-west of Pind-dadun Khan, now called the Mayo Mines, in commemoration of the Viceroy's visit, and of the veins of lignite and anthracite, the discovery of which have from time to time been announced as that of coal. In the territories of the Maharajah of Cashmere numerous veins of lead, iron, and copper are known to exist, but it is not the policy of the Jummoo Durbar to allow them to be worked, though many of the native shikarees dig out a little lead ore from lodes known only to themselves, and make them into bullets in the same primative method used by the early backwoodsmen of North America. In the adjoining state of Chumba, iron, lead, copper, and plumbago are found, but the high rates fixed for coolie hire and manual labour are likely to hinder European enterprise in that quarter. Iron is worked in the Kangra district by the Dogras; and in the adjoining Mundi State some eighteen mines of that metal are in operation. In the States of Sukyt, Erki and Belaspoor the powers that be are again the hindrances to the development of the mineral wealth; one of these petty Rajas has gone so far as to place sepoys as a guard for the purpose of preventing anyone from examining a very large lode of lead that is known to exist, and which was formerly successfully worked. Near Subathoo, lead mines are being coaverted to use and profit by a company of European and native speculators; the Maharajah of Puttiala, in whose territory most of the mines lie, being one of their number. We are informed that though the workings in these mines have not as yet reached any depth, the results and prospects are satisfactory.

The lessees of the mines and mineral lodes of the Talooqua of Wazeeri Rupi in the district of Kangra, we are told are only awaiting the termination of the present war in Europe to form a company for the working of their possessions.

The districts will be divided into two sections:—

1.—The Shigri Mine, leased on royalty by the Punjab Government for a period of twenty years.

2.—The mineral rights of the Talooqua of Wazeeri Rupi assigned in perpetuity subject to a royalty by the Jagheerdar.

To give a better idea of their locality, we will suppose a visitor to have started across the hills by the road leading from Simla to Dhurumsala, and in ten marches, aggregating 134 miles, to have reached Larji, which is just outside the limits of Wazeeri Rupi, a good bridle road, practicable for laden mules, extending the whole way. This is not the line by which ore would be conveyed to a market, but the usual tourist's route; the mercantile route to the plains lying at a much lower level, and very much shorter, Jullundur being the nearest point on the railway, about 130 miles from Kulu. At Larji the visitor has the Pilan Kothi of Wazeeri Rupi immediately in front and due north, with the Bithoo Kundi ridge containing deposits of salt and of precious serpentine, which when worked by the lathe into vases and other ornaments commands a considerable price. The Bithoo Kundi ridge joins to the Ruphroo and Dudroo ridges, with their vast deposits of copper, consisting of copper pyrites, purple copper, peacock ore, and grey copper, forming large lodes from which, whilst the ore was in a state of fusion, bunches of metal had boiled up. In the days of Rajah Maun Sing, about 200 years since, the natives had worked many of these bunches and removed a considerable quantity of ore, but foreign invasion and domestic commotions caused a stop to be put to their labours. No attempts seemingly had been made to touch the great underlying lode, which has far as at present known extends some 7 miles with lateral branches. Only at one place does any sinking on the true lode occur, and this is at the Kali Davi lode, which contains a quantity of grey ore, a highly argentiferous variety of copper. This working was abandoned through the superstitious fears of the natives. Indications of copper exist in many other places in this part of the grant, and some lead also is to be found. To the east of Pilan Kothi lies the Saicer Kothi with a mine of alum, and it is said a silver mine. The latter assertion has not yet been verified; there has only been time to explore very little of the area of the whole grant, consisting of 600 square miles. The rocks here are limestone with trap dykes, overlaid by clay-slate formations, which contain the copper.

The traveller now leaves the Dhurumsala road to his left at the Badool ferry, where a substantial wooden bridge is in course of erection, and crossing the little river of Harla, in whose bed boulders containing lead and copper ore have been found, passes through Kote Kurdi with its numerous lodes of iron, baryta, and manganese to the junction of the rivers Beas and Parbutti. Here are indications of copper lodes in four places, recent discoveries within the last year.

The road to be pursued now leaves the main valley of Kulu, and follows the banks of the Parbutti to the north. Following its course, the salt, iron, and copper of Chiol and Gular Pani are soon reached, and a short ascent leads to Chong, perched picturesquely up on a spur of densely wooded mountains. Two miles above this is the lead mine of Chitrani, formerly worked, but closed up and abandoned at the period of the Seikh conquest. About five mile further the Shatgurh Nullah with lodes of copper and silver-lead, is come to, and four miles further on the Pandoba ridge, which may be said to be the boundary of the Kanore section of the mines, containing several lodes of iron and silver-lead. From this ridge to the Kanor Khud, a space of two miles, the outcrops of lead lodes are visible in many places along the road side; the Mateora hill in particular being intersected with them in every direction. Arriving at the Kanor Khud, perhaps the most important mining centre of all is reached. Just below the road are fine adits driven on outcrops of lodes. A quarter of a mile up the Khud is the "Wheal Caroline" mine, blown up by the Seikhs, who to secure all the ore at once placed a tremendous charge of powder in it, bringing down on it and filling it with a great quantity of earth and stones. Their own expulsion from the country followed so soon after this exploit that they had no time to clear out the debris, which has lately been done in part and sufficiently to show that the mine contains:—

1.—A large lode of lead, holding 16 ozs. of silver to the ton.

2.—A still larger lode of lead holding 36 ozs. of silver to the ton, and about 3 per cent. of copper.

3.—A lode of silver yielding 96 ozs. to the ton, equal to the average of the Mexican mines, and with a trace of gold. The ore seems a cupriferous argentite or "silver glance."

Half a mile up the Khud is another lead mine; the ore of this only holds 12 to 14 ozs. of silver per ton, but is singularly free from impurities, containing no iron. There are other mineral indications in the same Khud, but they have not yet been sunk upon; the rock here is easily-worked clay-slate. Above the Kanor section, and on the road to the hot springs at Manikeran, are other manifestations of copper. The most northerly known mine in Wazeeri Rupi is that of Uchich, above Manikeran, said by the natives to have formerly been a silver mine, and transmuted by Aletany! A *bona fide* silver lode is believed to exist near it, but there has not yet been time to explore this part of the grant; indeed, it will take years to examine the whole of the 600 square miles properly.

The part of the property leased by the Punjab Government for 20 years, from April 1, 1870, consists of one mine at Shigri, in British Lahoul, situate about half a mile from the road connecting Kulu with Spiti. It is more an open quarry than a mine, being an enormous lode of antimony some 12 feet wide, traceable externally for several hundreds yards, and to all intents inexhaustible. The gangue stone of antimony is also very valuable, yielding zinc and tin. Without entering into statistics it may be stated that according to the report of the lessees the antimony can be mined, smelted, and delivered in England for about 30*l.* per ton, where it fetches 78*l.*, according to the last quotations.—*Friend of India: Serampore, Dec. 22.*

FURNACES.—The invention of Mr. C. N. MAY, Devizes, consists, first, in making the fire-bars of such furnaces hollow, in order to allow of the passage of water through them. These bars may either be fixed permanently in the boiler or they may be swung on trunnions fixed at one end or any other part, so that by drawing back a catch or other simple contrivance they may be allowed to fall and thus clear the fire-grate. Feed-water may also be pumped through these hollow bars, or allowed to flow freely through them. These bars may also be provided with receptacles for holding the mud, which can be readily cleaned; two or more dampers are also provided underneath the bar, and by working these dampers one or more at a time the fire may be kept clean and free from clinkers. The dampers are applicable to any kind of fire-bar.

FURNACES.—By the invention of Mr. A. PONSARD, Paris, the gas generator, the front face of which is inclined, is provided with an oblique grating for the reception of the combustible gas, which fed into the apparatus in the ordinary manner. The gas is admitted into the combustion chamber by a pipe furnished with a regulating valve and partitions, which divide the gas into streams, which come in contact with currents of air passing from the regenerator. Cold air is supplied by a fan or blower at a low pressure to the body of the gas generator, where the attendant is placed who attends to the heating, and a portion passes through the grating to support combustion, the remainder being conducted into the regenerator below, and passing through perforated bricks, which heat it has it ascends. The hot air passes into the combustion chamber, and mixes with the gases from the gas generator, and the flame after passing through the upper chamber enters the regenerator, and there leaves the greater portoin of its heat, passing through the perforated bricks before entering the chimmey. The body of the gas generator may be opened and the apparatus worked with free access of air; vertical pipes are set in the body of the furnace, and serve as retorts in which the substances to be smelted are placed, and the upper extremities of which pass through the roof of the furnace, and are open to the air, their lower extremities resting on the bed of the furnace. The operation is rendered continuous by continually charging the upright pipes or retorts with ore, flux, and fuel.

PEAT CHARCOAL.—Dr. RITTERBANDT, of Eastbourne-terrace, Hyde Park, has specified the nature of his invention for improvements in the manufacture of peat charcoal (partly a communication to him from Jean Baptiste Passedoit, Torrebianca, Spain, and partly his own invention) to be improvements upon an invention for which a petition was lodged, and a complete specification filed March 29, and consists in the manufacture of a fuel having either crude peat or unwashed carbonised peat as its basis. The crude peat or unwashed carbonised peat, which may be used alone or mixed with other combustible materials, having been pulverised, and then mixed with pitch or tar in the manner described in the specification aforesaid with reference to carbonised peat, is then moulded into any desired form, and, finally, after being so moulded, is baked in furnaces similar to those used in the manufacture of fuel known in France as "charbon de Paris" or "agglonierés." In this state it may be used as a fuel for culinary, metallurgical, and other purposes.

Meetings of Mining Companies.

HOLYFIELD LEAD MINING COMPANY.

The annual general meeting of shareholders will be held at Alston, on Tuesday next, when the subjoined report will be presented:—

Feb. 7.—We have continued the main sump from the Horse level to a depth of 18 fms. 3 ft., and are now about 3 ft. into the 4 fms. limestone, and on the south side of the vein. We had the vein in the sump until we got into the plate below Quarry Hazle, which is about 8 fms. from the sump top, at which point it began to incline to the north in going down. At a depth of 13 fms. we came to what is called the Sill Bed, where we first got quit of the water which had hitherto materially retarded our operations, and from the top of this stratum we made a cross-cut north 4 fms., and cut the vein, out of which we obtained some pieces of ore. At this point we sunk a sump in the vein to a depth of 6 fms., in order to prove it. After sinking about 3 yards we met with very nice ore, which regularly improved for 7 or 8 yards in depth, and produced about 25*l.* worth of lead ore in sinking. If this continue as it is, it will work to a profit. This sump was sunk a few feet into the limestone, but the vein and the joints near it, being all full of clay, caused the water to stop, so that we could not very well get any deeper. We are now sinking the main sump from the Horse level, and are at present in the 4 fms. limestone. If it continue to take the water as at present, we will sink to the bottom of this sill, and then make a cross-cut to the north proving the vein in the limestone. Then by cutting about 3 fms. to the south we will cut another vein, called the little south vein. I may just say that both of these veins have been very rich above the Horse level, and our proposed working will prove them both in the depth from the present sump, all the ground being whole, and unexplored below the level. Should these veins prove to be rich in the limestone, with the ore we have already in the Sill Bed, we shall soon be able to send a large quantity of ore to market, and again make Holyfield a dividend-paying mine.—JOHN PEART.

ENGLISH AND AUSTRALIAN COPPER COMPANY.

The twentieth annual meeting of shareholders will be held at the London Tavern on Wednesday, when the directors will lay before the proprietors their annual report, and the accounts for the year ending June 30, 1870. The gross quantity of ore, regulus, precipitate, and rough copper received from various mines from July 1, 1869, to June 30, 1870, has been—

	1869-70.	1868-69.
Ore	Tons 2790 15 1	Tons 1710 17 0
Regulus	227 15 0	237 9 0
Precipitate	237 2 3	—
Rough copper	484 11 0	519 11 2
Tons	3740 2 0	Tons 2467 16 2

The quantity of ore, regulus, and precipitate smelted at the Port Adelaide Smelting Works from July 1, 1869, to June 30, 1870, was—

1869-70.	1868-69.
Tons 3125 1 0	Tons 2921 5 0

The quantity of copper made at the Adelaide Smelting Works from July 1, 1869, to June 30, 1870, was—

1869-70.	1868-69.
Tons 1297 12 1 9	Tons 1526 16 2 24

The quantity of copper shipped from South Australia during the year ending June 30 last has been—

1869-70.	1868-69.
Tons 1349 14 1 16	Tons 1219 15 0

BURRA BURRA MINE.—By the last advices from Adelaide the pumping-engine was again at work, and the new dressing appliances were all but complete. It was not expected, however, that ore in any quantity would be ready before the month of February.

WHARF AT PORT ADELAIDE.—The whole frontage of 691 ft. is now completed, and at the date of last advices the wharf was entirely occupied with vessels. A space for floors of 100 ft. in width has been separated from the smelting works by a substantial fence 6 ft. high: and a tramway laid down, connected with the railway to the city of Adelaide, and the railway northwards to the Burra Burra Mine—the whole forming a most compact and complete freehold property, valued by Mr. Richardson at 35,269*l.* 3s. 11d.

SMELTING WORKS AT PORT ADELAIDE.—These are now separated from the wharf by a substantial fence, and, together with the freehold land on which they stand, form a distinct property, valued by Mr. Richardson at 26,324*l.* 17s. 10d. Fifty thousand tons of slags, which are not taken into account in the above valuation, have been used for forming solid floors for these works, which consist of seven smelting furnaces, one refinery, a stack 160 ft. high, and suitable offices; the whole connected by a separate tramway with the wharf and with the Burra Burra Railway.

SMELTING WORKS AT NEW LAMBTON, NEAR NEWCASTLE, NEW SOUTH WALES.—These consist of six furnaces, a refinery, stack, and requisite offices, connected by rail with the coal pits on one hand, and with the Port of Newcastle on the other. The freehold land on which they stand comprises 36 acres, vested in the English and Australian Copper Company (Limited), and a very advantageous agreement for supplies of coal, haulage of ore and copper, &c., has been secured. The value of these works is taken simply at the amount expended—87371. 14s. 5d., without reference to the value of the freehold land.

KOORINGA WORKS.—A portion of the plant and machinery, formerly used at these works, has been transferred to the New Lambton Works, and other portions will follow should it be found desirable. The buildings, which are for the most part substantial and in good repair, will be held for a time to enable the manager to see if it would be politic to resume smelting there, should the produce of ore from the mine prove to be large. In the meantime Mr. Hamilton has his attention directed to the letting of any portion which may be found available for other purposes.

PORT AUGUSTA RAILWAY.—A survey has been engaged on the line by Government, and the last advices from Adelaide state that there is a greater probability now than ever of a useful measure being passed by the Legislature.

REALISATION OF LAND TEAMS AND FARM STOCK.—This has not yet been carried out to any considerable extent, but it is hoped that the improved prospects of the colony will soon enable the manager to realise their estimated value.

The board, having in view the altered and favourable condition of the company, effected by the completion of the railway from Adelaide to the Burra, the re-opening of the Burra Burra Mine itself, the completion of the company's wharf at Port Adelaide, and the erection of smelting works at the mouth of the coal pits in New South Wales, have considered this a fitting time to review the position of the company, and to fix the valuations of their property upon such a basis as should continue undisturbed. They, therefore, instructed their manager at Adelaide to procure from Mr. Richardson a new and careful valuation of the company's real property, and to re-value all the moveable assets which time and altered circumstances had considerably affected. This has been done, and the directors are thereby enabled to present the accounts in a simplified and improved form, especially the balance-sheet and the statement of the Australian assets, in which the several items of real property are more distinctly rendered than in former accounts. They have also been enabled to adjust the item of depreciation of teams, &c., held in suspense in last year's accounts, and to reduce the old balance at debit of profit and loss, to 1418*l.* 10s. 1d., which has been written off the reserve fund. The reserve fund now stands at 5471*l.* 3s. 11d., secured by copper warrants. The profit and loss account for the year—July 1, 1869, to June 30, 1870—shows a balance at the credit of 344*l.* 19s. 6d.

The directors regret that the result of the year's operations does not on this occasion admit the payment of a dividend. Had only the price of copper in England and India ruling at the commencement of last year been maintained, this desirable result would have been secured; but the war prevented this, and at one period of the year forced the price down to the lowest point ever known in the history of copper. A reaction has since taken place, which will be strengthened when peace is declared, and continental business resumed—an improvement which will favourably affect the stock in hand, and the operations of the current year.

The following directors retire by rotation:—Alfred Cobbett, Esq., and Spencer Herapath, Esq., who, being eligible, offer themselves for re-election.

COAL MINING IN AUSTRALIA.—The Australian Agricultural Company meeting will be held on Tuesday. In their report the directors state—"As regards the colliery, the ordinary trade was brisk, and owing to the increase of vend a larger amount of profit was earned, but no increase of price was established, and the consequence was that the high rate of labour pressed as severely as it had ever done since the reduction from 10s. to 8s. per ton. We are not however, without hope of still further improving the net return through the gradual increase of foreign trade and colonial consumption, and the saving of labour by new appliances. During the year an underground engine, fitted for hauling and pumping, which was sent out some years ago, has been fixed, and at the date of last advices was ready for work. The new rolling stock, consisting of 45 six-ton wagons, built on the most improved principles, was forwarded to the colony in three shipments in the months of September and October last. The total cost, including freight, &c., was 5183*l.* 4s. 6d., which is in course of payment according to contract. The heading driven from the old workings to the site of the new pit has been completed, and we have great satisfaction in announcing that the coal seam is proved to be undisturbed and of high quality throughout the whole distance, and that the dip is sufficient to make the new pit answer its purpose. In the last half-yearly report, presented on Feb. 22, 1870, we stated that on Mr. Liddell's recommendation we had determined to make it large enough both for lifting coal and pumping water. Owing, however, to information subsequently received, and with a view to limit the expense to the requirements of the next few years, Mr. Liddell has advised us to revert to the original scheme, which was confined to the drainage of the works by means of a steam-pump fixed at a low level. For this purpose a shaft of small size will be sufficient, and instructions have been sent out to limit it to a diameter of 10 ft. This will effect a saving of expense in a variety of ways, and leads us to hope that this case may prove an exception to ordinary experience, by a completion of the work within the estimated cost.

[For remainder of Meetings see to-day's Journal.]

"THE CITY OF LONDON DIRECTORY."—The first annual edition of a handsome and useful work bearing this title has just been issued by Messrs. W. H. and L. COLLINGRIDGE, of Aldersgate-street, and from the great care which has evidently been bestowed upon its compilation it seems well worthy of a permanent place among the records of City progress. In the arrangement of the Directory several new and valuable features are introduced, not the least striking being the placing of the addresses in each street in such a manner that the houses on each side of a street facing each other occupy a corresponding position in parallel columns in the Directory. An important addition has likewise been made by inserting the floor upon which a man's dwelling or place of business is situated; thus we find that Mr. Thomas Ross, accountant, occupies the fourth floor at 110, Cannon-street; Mr. Michael Henry, patent agent, the second floor at 68 Fleet-street, and so on; particulars being likewise given which will enable the reader

to determine the particular parish and ward in which either of the houses mentioned are situated. The Directory affords, moreover, some interesting facts with regard to the extent of the City; thus, the number of streets, courts, alleys, and places in the City is 1039; no less than 33,938 titles are required in the Alphabetical Directory to record the firms, churches, chapels, charities, societies, &c., and there are 909 trades and professions. The Conveyance Directory affords a guide for the dispatch of goods to 8434 places, and the 680 suburban towns and villages give employment to 1615 road carriers, and to so many omnibuses that no less than 156 starting places are necessary to accommodate them. The Public Companies' Directory will be found exceedingly useful, for it gives not only the names and addresses, but the capital, directors, and other officers, and dividends paid also. The Directory certainly deserves a place in every City office.

PROGRESS OF SCIENCE AND ART.—Another of the very interesting volumes from year to year prepared by Mr. JOHN TIMBS—The Year-Book of Facts in Science and Art—has just been issued by Messrs. Lockwood and Co., of Stationers' Hall-court. Commencing very appropriately with a brief sketch of the life of Professor Huxley, the reader is supplied with an abundance of information concerning the principal inventions which have attracted attention during the year. The sketches referring to the mechanical and useful arts, natural philosophy, electrical science, chemical science, natural history, geology and mineralogy, and astronomy and meteorology is well calculated to meet the tastes of all classes; for it must be remembered that the style is so thoroughly popular that any technical knowledge of the sciences themselves is not at all necessary to enable the whole book to be read and enjoyed. As a single notice seldom exceeds half a page in length, the book will be found a cheap and entertaining companion for railway travellers, and will tend to shorten many a tedious journey.

FOREIGN MINING AND METALLURGY.

The Belgian rolling mills and ironworks are carrying on operations with energy. It is expected that great part of the rails required for the renewal of the French railways which have been injured in the course of the war will be ordered in Belgium, as French metallurgical industry cannot for the moment meet the demand which is likely to arise. As regards English iron, it is not expected to prove a formidable competitor, in consequence of its greater dearness, while by reason of a great want of labour the German furnaces can scarcely be kept in operation. It does not follow, however, that this state of things will continue in Germany when the war terminates. A contract for 2000 tons of rails is about to be let at Amsterdam, for the Dutch State Railways. The Produits au Flenu Colliery Company will pay, on March 1, its dividend for 1870. The Chartreuse and Violette Colliery Company has announced payment of its obligation interest, as has the Blanzy Coal Mines Company.

Advices from Essen (Prussia) state that the metallurgical interest of that district is suffering from day to day from the continuance of the war. The want of coal and coke is causing much injury, many works having been obliged to suspend operations in consequence. In every locality complaints are heard as to this state of things, and also of the want of trucks for deliveries. These complaints have thus far, however, proved quite vain, as coal does not arrive, prices become exorbitant, and the managers of the local railways cannot succeed in procuring either locomotives or trucks to forward the raw material entrusted to their care. The price of coal and coke has attained such a rate in the Essen group that the cost of producing iron is almost equivalent to its selling price. Notwithstanding this, the price of the iron made in the group does not advance, as the importation from abroad, and especially from Belgium, is very considerable, and because the price of Belgian raw iron is comparatively low. Many proprietors of blast-furnaces have blown out their works from the want of coal and coke, and because they do not like to work without a profit. In the Siegen district, where there were 35 furnaces in activity at the commencement of July, 1870, there are now only 15 at work. As regards merchants' iron, the aspect of affairs is still more depressing. Orders are scarce and unimportant; this is usually the case, more or less, however, in January every year.

The aspect of political affairs being considered to have improved, the Belgian coal trade is expected to present shortly some revival. Hitherto, it has not been practicable, however, to make larger deliveries, means of communication having been destroyed in many localities, while boat owners demand extravagant rates for cargoes destined for Paris. But in spite of all these difficulties, Belgian coal owners can still realise important profits by making deliveries of coal to the French capital, as coal is selling in Paris at extraordinarily high rates. Orders continue to flow in from Germany and Holland—especially from Germany, where several industrial establishments have been compelled to suspend operations by reason of the lack of combustible. Unfortunately, means of transport to Germany still make default. Belgian coalowners are reluctant, upon the whole, to enter upon long-termed contracts, as they anticipate an advance in prices. The demand for coal in Belgium on home account continues pretty good. The rolling-mills, the glassworks, and the other industries using coal are actively at work, and are consuming a great deal. But, however, active the demand for Belgian coal on home account may be, it bears but a small proportion to the production.

Chilian copper, which hitherto had been principally dealt in at Havre, has made its appearance upon the Antwerp market, some small quantities having changed hands at 68*l.* per ton. At Havre, Peruvian mineral (pure standard) has made 70*l.* to 70*l.* 10s. per ton. United States, Baltimore, 76*l.* to 78*l.*; ditto, Lake Superior, 80*l.* to 86*l.*; and Mexican and Plata, in bars, 66*l.* to 68*l.* per ton. At Marseilles, Toka for consumption has made 80*l.* per ton; refined Chilian and Peruvian, 80*l.* per ton; and rolled red copper, in sheets, 80*l.* to 84*l.* per ton. At Rotterdam, Drontheim has been quoted at 50 fls. to 52 fls. Banca tin has been quoted at 78 fls.; and Billiton at 77 fls. at Rotterdam. At Marseilles lead in saumons, first fusion, has realised 18*l.* 16s.; ditto, second fusion, 17*l.* 8s.; ditto, argentiferons, 17*l.* 18s.; ditto, in shot, 20*l.* 16s.; rolled and in pipes, 20*l.* 16s. per ton. At Rotterdam, the quotation for Stolberg has been 11 fls.; and for miscellaneous marks, 10¾ fls.

FOREIGN MINES.

DON PEDRO NORTH DEL REY.—Copy of telegram from Lisbon: Produce for December, 6411 oits.; weighed to Jan. 18, 2191 oits.

TAQUARIL.—Telegram from Lisbon: Produce for Dec., 2138 oits. Better expected in January.

ALMADA AND TIRITO (Silver).—The following telegram has been received by the directors from their general manager:—"Clemes, Jan. 26: December profit for month, $5243; north looking well."

CHONTALES (Nicaragua).—The directors have advices from Mr. Belt, dated Jan. 6: Return of gold for December, 269 ozs., from 1009 tons of ore; average yield, 5½ dwts. per ton; cost for the month, $4350. Mr. Belt reports that the connection level at San Antonio Mine, contrary to his expectations, continued poor throughout the month, and, therefore, the returns have not come up to his anticipations, but on the departure of the mail there were indications of improvements. He also states—"The stopes above No. 6 level have greatly improved, and are now worth 6 dwts. per ton. We have driven the end of No. 6 level east 8½ varas; it is 4 ft. wide, and worth 7 dwts. per ton. This is an important point, as it is the deepest part of our workings, and is almost directly over where we proposed to cut the lode in the deep cross-cut. From the general appearance of this mine we have every reason to expect that we shall make a profit during the present month.—San Benito Mine: The upper level has been driven 14 varas; the lode is 4 feet wide, and worth 4 dwts. per ton." The health of the establishment continues good.

— J. Tonkin, Jan. 4: I beg to hand you my report of San Antonio Mine for December: No. 1 stope, in the back of No. 6 level, has been stoped 56 varas; the lode is 3 ft. wide, worth 4 dwts. of gold per ton. No. 2 stope, in the back of the same level, has been stoped 55 varas; the lode is 4 ft. wide, worth 6 dwts. of gold per ton. A stope in the back of No. 5 level has been stoped 50 varas; the lode is 3 ft. wide, worth 10 dwts. of gold per ton. A stope in the back of the connection level has been stoped 38 varas; the lode is 2 ft. wide, worth 5 dwts. of gold per ton. A stope in the back of eastern level, west of new cross-cut, has been stoped 33½ varas; the lode is 3 ft. wide, worth 4 dwts. of gold per ton.—Driving: The repairing of No. 6 level is now completed, and we have driven this month 8½ varas on the course of the lode, which is 4 ft. wide, worth 7 dwts. of gold per ton. The connection lode has been driven on the course of the lode 23¾ varas on a lode 3 ft. wide, worth 3 dwts. of gold per ton. The level driving west of new cross-cut on the course of the lode has been extended 13 varas; the lode is 3 ft. wide, worth 3 dwts. of gold per ton. The level driving east of the Santo Domingo cross-cut on the course of the lode has been driven 7 varas; the lode is 3½ ft. wide, worth 3 dwts. of gold per ton. I am pleased to report a decided improvement both in the No. 2 stope and in the No. 6 level. The number of tons sent to the stamps this month is 1009, yielding 5½ dwts. per ton, equal to 269 ozs. melted gold.

JAVALI.—The manager in his report, ending January 5, says that although the month has been a broken one, owing to the Christmas holidays, and been further shortened by the early departure of the mail, he is enabled to send 349½ ozs. of gold, against a working expenditure of $2614·70, leaving a profit of $1754·5. This result is all the more satisfactory, as it was principally obtained from ore rejected as unfit for the machinery formerly in use, and of which on there is a quantity estimated at not less than 30,000 tons on the surface, a great part of which can and has been conveyed to the mill at the small cost of 5d. per ton. The whole mill, including twenty stamps and three pans, is now at work, the new machinery, supplied from England, doing well. A cross-cut, giving easy access to quantities of good ore of the Socorro, has been re-opened. Pollock's tunnel, now driving into virgin ground, yields excellent stuff. There having been rain all the month, water is still plentiful, though the dry season has set in in the low lands. The health of the district is excellent, and labour abundant. By the establisment of a new line of steamers to San Utaldo, the company saves $1000 a year.

BATTLE MOUNTAIN (Nevada).—J. Richards, Jan. 19: Since the erection of the horse-whim at the Virgin shaft better progress has been made. The shaft is already down 15 feet. The fine stones of ore occasionally met with therein I look upon as a good indication, and should we be fortunate enough to strike into a course of ore at this point it will be well. The 73 north end is suspended during the putting in stull in the back of the 73 ft. level, north of Roach's winze, and I am glad to say the lode in the stope has materially improved. It is a good lode of ore, from 1 to 2 ft. wide, of rich red oxide, green carbonate, and a mixture of prian, &c. As soon as the stull is complete (which will take some time, as the ground is somewhat heavy) a pare of men will be able to work to advantage, and will raise a fair quantity of rich ore. We have also commenced stoping in the bottom of the 73 ft. level, between Roach's winze and the shaft, for the purpose of proving that piece of ground, and which is producing a good quantity of rich ore. As soon as I can get the shaft down to the 113 feet, I will drive towards and hole to Roach's winze. This will cut out this piece of ground in such a manner as to admit of its being stoped much more speedily and economically, and enable us to increase our present returns of ore at a less cost in proportion per ton, and should the further deepening of the shaft make discoveries of ore we shall be fortunate in so doing. The stopes in the 37 having become poor are suspended. On the 10th inst. 836 sacks of ore, weighing 106,500 lbs., we put on board the cars, consigned to Heilman Brothers and Co., of San Francisco—so that to this date there are 836 sacks of ore at San Francisco, and we have underground and at surface 1000 sacks, 500 of which I hope to be able to get to the station this week.

EXCHEQUER.—L. Chalmers, Jan. 16: During the past week the winze was sunk 5 ft., and is now down 91 ft. in good ore. A small streak of silver glance was struck on Saturday, of which I send you a specimen. The main tunnel was driven 5 ft.; the rock is getting harder, chiefly quartz, and is looking better; this is now in 417 ft.

PACIFIC.—J. Brown, Jan. 19: Lander Hill Mine: The ground in the 550 ft. level south is a little better. I have put in 40 feet of air-pipes, to throw air to this end. The ground in the 550 ft. level, north-west, is favourable for driving, and the men are making good progress. The lode in the end of the 400 ft. level west has since my last been split in two parts—the north part is about 3 in. wide, producing stones of ore; the south carries a flookan, which I think will form the main part of the lode, where the two branches unite westward at no great distance. In the new shaft we have cut a small branch over the break, in driving south. I do not think this is the main lode, as we find stones of quartz in the break, and from the appearance to-day we shall have several feet further to drive to cut the main lode.

PONTGIBAUD.—W. H. Rickard, Feb. 2: Roure Mine: The 80 metre level, south of Richards's shaft, is in a lode 5 ft. wide, containing a little saving work of low quality. The cross-cut east at this level is rather spare for progress. The rise under Agnes' shaft has entered a little softer ground. The 60 rise yields ¼ ton of ore per fathom. The 60 cross-cut east is now making good progress towards Virginie's lode, which we hope to attain in two months more driving. The 20 metre level north, on Virginie's lode, yields a little saving work. The 20 south yields ⅛ ton of ore per fathom. The adit in the same direction yields 1¼ ton per fathom. The stollen south of Paul's shaft continues in soft, unproductive ground. The intermediate level, north and south of Paul's old shaft, yields a little saving work, opening ground that will work at high tribute. The adit cross-cut east from the mill is a little stiffer. Our tribute pitches continue without change.—La Grange: The 100 metre level, north of Nosky's shaft, yields ⅛ ton of ore per fathom. The winze below the 80 yields a little ore-stuff. Our tribute pitches continue to yield their usual quantity of soft, unproductive ground. The intermediate level, north and south of Paul's old shaft, yields a little saving work, opening ground that will work at high tribute. The adit cross-cut east from the mill is a little stiffer. Our tribute pitches continue without change.—La Grange: The 100 metre level, north of Nosky's shaft, yields ⅛ ton of ore per fathom. The winze below the 80 yields a little ore-stuff. Our tribute pitches continue to yield their usual quantity of coarse ore-stuff. At Bouzarat the ground continues favourable for driving.—La Brousse: The 120 metre level, south of Basset's shaft, yields ⅛ ton ore per fathom. The 100 yields ¾ ton. The 80 south yields 1 ton per fathom. The 60 south yields a little saving work; the lode is hard, and of a strong, regular appearance. The 60 north, on the western branch, is holed to the cross-cut, and the men set to stope. The 40 north continues poor. Tribute pitches continue their good yield of ore.—Pranal: The 70 metre level north yields ¼ ton of ore per fathom. The same level south yields ¾ ton per fathom. The 50 north is unproductive. The 50 south yields a little saving work. We have three winzes sinking below this level, yielding on an average 1 ton of ore per fathom each. The 30 south is unproductive. The adit south of Bontoux's shaft continues in soft flookan. We have 16 tribute pitches working, yielding a fair quantity of ore-stuff.—Surface: Our dressing operations have been very much hindered by the severity of the frost; consequently, our samplings have only amounted to 204 tons.—St. Amaut Roche Savine: The ground in Susan's shaft is a little changed for the better; consequently, our progress is more satisfactory. In the adit we have set to cross-cut east to cut the part of the lode lying in that direction; the part driven on is poor. At La Butte we have intersected a vein in the cross-cut from the trial shaft, which underlies very fast to the east; it is composed of quartz, spotted with mundic and clay. The surface trial north of the workings has been suspended for a few days because of the severe weather.

[For remainder of Foreign Mines see to-day's Journal.]

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending Feb. 12 were 8913*l.* 7s. 9d.

London: Printed by RICHARD MIDDLETON, and published by HENRY ENGLISH (the proprietors), at their offices, 26, FLEET STREET, E.C., where all communications are requested to be addressed.—*February* 18, 1871.